

"I N D E X"

SECTION 1	Pump data sheet	
SECTION 2	Test certificate:	C 32661 C 32588 C 32637 C 32636 C 32643 C 32638
SECTION 3	General arrangement	EM 028922
	Vertical centrifugal pump	EM 186704
	Cross section + part list	EM 185658
SECTION 4	Instruction and maintenance for:-	
	- Pump type QL	
	- Data sheet instrument	SE.IDS.001A/10.02735
	- Solenoid valve	

**Worthington**W.P.I. Worthington Pompe Italia spa  
DESIO

CLIENTE - CUSTOMER: CODEVASE - BRASIL

Ubicazione impianto - Plant location:

## CARATTERISTICHE PRINCIPALI - MAIN SPECIFICATIONS

## POMPA - PUMP

Tipo (Type) 32 QL 31

Matricola (Serial No.) D 46796 + 46801

Servizio (Service) IRRIGATION PROCESS &amp; DESIGN DATA

Contrassegno (Item) Commessa (Order) 10-02735

## DATI DI PROGETTO - DESIGN DATA

## NOTE

Fluido pompato (Liquid handled) CORRENTE RIVER WATER

Temperatura esercizio (Operating temperature) °C

AMBIENT

Viscosità max. (Max viscosity)

Peso specifico (Specific weight) Kg/dm<sup>3</sup>Pressione aspirazione (Suction pressure) Kg/cm<sup>2</sup>Pressione mandata (Discharge pressure) Kg/cm<sup>2</sup>

Prevalenza man. totale (Total dynamic head) m.

30.5

Portata contrattuale (Capacity) m<sup>3</sup>/h

5760

N.P.S.H. m.

5.3

Velocità (Speed R.P.M.) giri/l'

720

Potenza assorbita (Input HP) HP

719

Potenza motore elettrico (Driver HP) HP

## COMANDO - DRIVER

BY CUSTOMER

## TENUTE - MECH. SEAL

Meccanica (Mech. seal)

( Lato comando (Driver side)

( Lato opposto (Opposed side)

A baderne (Gasket type)

## GIUNTO ACCOPPIAMENTO - COUPLING

RIGID

## LUBRIFICAZIONE - LUBRICATION

Caratteristiche olio (Oil viscosity) °E a 50 °C

Quantitativo primo riempimento (Oil filling) lt.

## CUSCINETTI - BEARINGS

Lato comando (Driver side)

Lato opposto (Opposed side)

## ALLEGATI - ENCLOSED

Disegno ingombro (Dimensional drawing) EM 028922

Disegno in sezione (Sectional drawing) EM 185658

Curva caratteristica (Performance curve) C32661, C32588, C32637, C32636, C32643, C32638

Elenco parti ricambio (List of spare parts)

Disegno tenuta meccanica (Mech. seal drawing)

Bollellino istruzioni (Instruction book) QL





WORTHINGTON  
POMPE ITALIA SPA

Q.A.

Desio (Mi)  
Via Rossini, 90/92

25.10.88

# CERTIFICATO di COLLAUDO

## TEST CERTIFICATE N° C 32661

TIPO POMPA

TYPE OF MACHINE 32 Q L 31

Matr.

Serial N° 46801

Ord. 10.02735

L'azionamento è stato realizzato mediante motore elettrico  
Type of electric motor used for test

accoppiato con giunto  
Drive made through

MATERIA

e/o riduttore - moltiplicatore  
and/or reduction gear - over gear

GUSTI 2:1

La prova è stata eseguita con acqua alla temperatura di  
Test has been carried out with water at a temperature of

Misuratore di portata  
Capacity measured with

VENTURIMETRO K 3534,5

venturimeter-diaphragm: Q = K - √ h - gauge tank: Q = K - √ t

cassone tarato: Q = K - √ t

Tensione disponibile  
Voltage available V 6000 Hz 50  
Pressione barom. m. Tens. vap.  
Atm. pressure m. Vapour press. m.

### DATI CONTRATTUALI

#### CONTRACT CONDITION OF SERVICE

N.	Velocità rotaz. n. giri/1'	h m H <sub>2</sub> O	Portata Q. m³/h Capacity Q. cu.m./h.	Mand. Press. gauge Hm. m.	Asp. Suction press. H m.	En. cin. Kin. En. Δ v² 2g m.	Preval. Manom. totale T.H.D. HDT m.	NPSH m.	RISULTATI RAPPORATI A FIGURES RELATED TO					giri/1' R.P.M.		Q cu.m./h				liquido liquid					
									Kw W <sub>1</sub>	W <sub>2</sub>	Rend. motore Motor eff. η m%	Potenza assorb. Na kw abs.	Q m³/h cu.m./h.	H HDT m.	Na Kw	η p Eff. %	NPSH m.	T.H.D. m.	n. g/1'		R.P.M.	N <sub>s</sub> kw	η <sub>p</sub> Efficiency	NPSH m	Curva Perfor. curve MC
① 4 m H <sub>2</sub> O	1.59	1.52	8814	12	160	1.12	14.72		680	324	92.4	556.6	8553	13.9	508.6	63.5				5760	°C water				
1.03	2742	0.89	6422	25		0.69	27.29		728	352	92.3	598.1	6716	25.7	546.5	86				30.5	°C pumpaggio				
0.85	3742	0.59	5343	30.4		0.59	32.52		717	348	92.4	590.4	5796	30.6	533.5	89.6				720	p.s. 1				
0.61	4	0.57	5423	32.3		0.43	34.33		703	338		577.1	5268	32.3	527.3	88				537	viscosità viscosity				
0.52	5743	0.43	4867	34.4		0.34	36.34		685	325		559.9	4716	34.1	509.5	86				5.3	C <sub>0</sub>				
	6	0.65	2850	40.6		0.12	42.32		621	290		505.1	2761	39.7	459.6	65				Asp. nozzle Ø	C <sub>01</sub>				
	7			42.3			43.90		495	200	91.5	381.6		41.2	347.2					Mand. nozzle Ø 32"	C <sub>E</sub>				
	8																								
	9																								

### OSSERVAZIONI E RILIEVI REMARK AND NOTES

La prova è stata eseguita in presenza del Sig.  
Test has been witnessed by

che dichiara di approvare i dati esposti per conto della Società  
who accepts the above figures on behalf of Messrs.

Contrassegni (item)

TOSHIBA D. BRASIL SA - CODE VASF.

Per la Ditta Committente  
Customer's signature

Per la Worthington  
Worthington

### VIBRAZIONI MAX (PK-PK)

Flow	COUPLING SIDE		OPPOSITE COUPLING SIDE	
	V	H	V	AX
MAX	50	45		32
100%	40	35		30
	50	42		35
MIN.	52	40		30



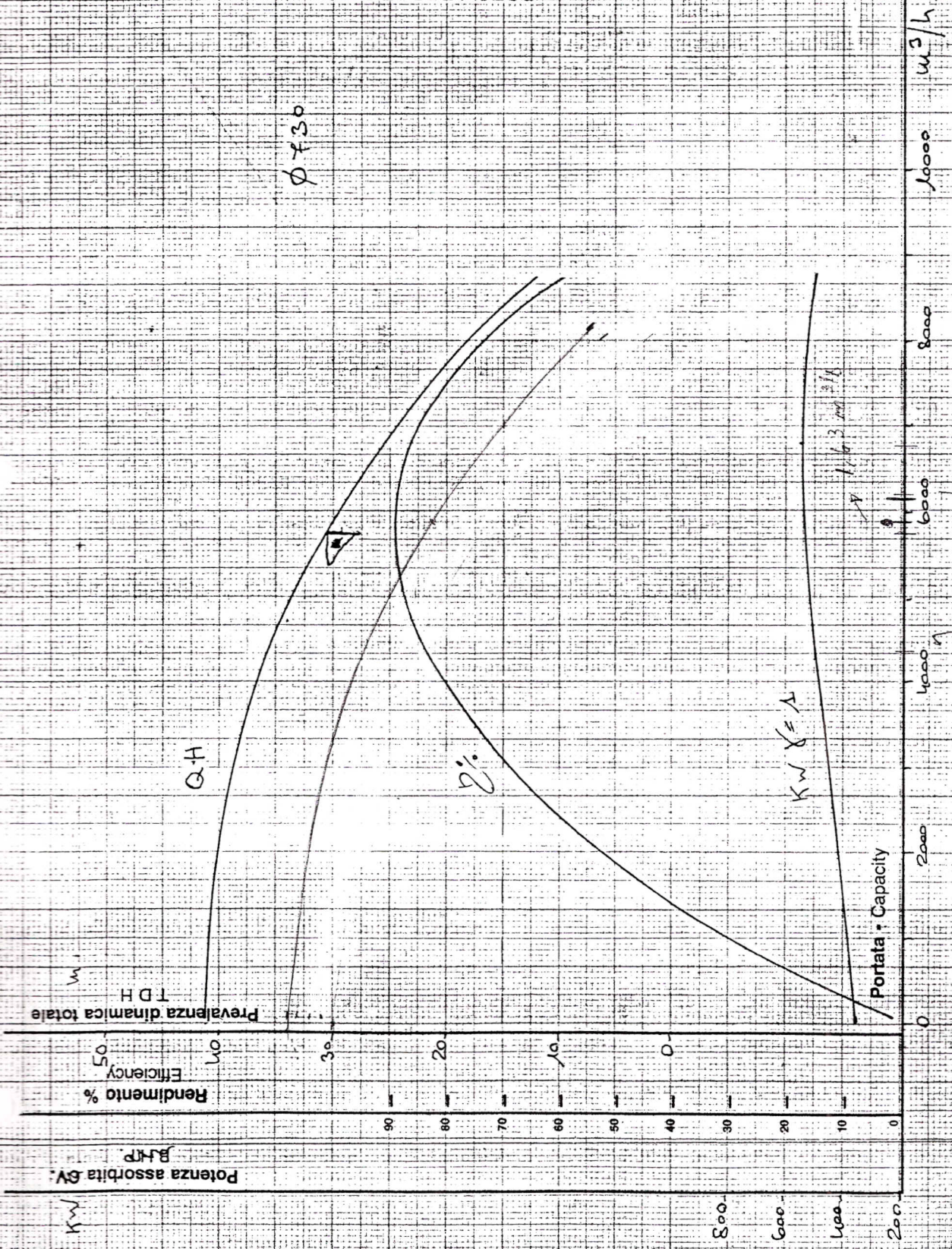
Questa pompa viene  
This pump is guaranteed  
the following C.O.S.

Portata m<sup>3</sup>/h  
Capacity 18.5 G.P.M.  
Preval. Din. Tot. m  
Tot. D.Y.H. Head-ft  
Giri al primo  
R.P.M.  
Rendimento  
Efficiency %  
Peso specifico  
Sp. GR.  
Viscosità  
Viscosity  
Fattore di correzione  
Factor for viscosity  
Temperatura di pomp. °C  
Pumping Temp. °F

Amb.  
Questa curva indica la prevalenza e i rendimenti  
presunti e diverse altre portate, ma questi dati  
supplementari, sono puramente indicativi e  
non garantiti.

Le prestazioni indicate sono soggette alle tol-  
leranze stabilite dall'Europump.

This curve shows the expected heads and effi-  
ciencies at other capacities, but this additional data  
is only approximate and not guaranteed.  
Our performance data is subject to the Europump  
tolerances.



Data  
Date  
N. MC  
Curve

CURVA PER POMPA TIPO  
Size and Type  
32 QL 31  
γ = 46801

ORDINE N. 10.02135  
Order  
POS. 1,70 m<sup>3</sup>/h  
Item

PREVENTIVO N.  
Proposal  
Ch. 120

**Worthington**  
W.P.I. Worthington Pompe Italia spa  
DESIO





WORTHINGTON  
POMPE ITALIA SPA

# CERTIFICATO di COLLAUDO

TEST CERTIFICATE N° C 32588

TIPO POMPA  
TYPE OF MACHINE 32 Q L 31

Matr. Serial N° 46796

Q.A.

Desio (MI) 28-9-88  
Via Rossini, 90/92

L'azionamento è stato realizzato mediante motore elettrico  
Type of electric motor used for test

TEST Rotor N° 17 HP 1000 1480 Hz 50 V 6000 l

accoppiato con giunto  
Drive made through MAIMA

e/o riduttore - moltiplicatore  
and/or reduction gear - over-gear GUSTI 2:1

La prova è stata eseguita con acqua alla temperatura di  
Test has been carried out with water at a temperature of

Misuratore di portata  
Capacity measured with VENTURIMETER 2K 3534.5

venturimeter-diaframma:  
venturimeter-diaphragm: Q = K -  $\sqrt{h}$  - gauge tank: Q = K -  $\sqrt{h}$

DATI CONTRATTUALI  
CONTRACT CONDITION OF SERVICE

N.	Velocità rotaz. giri/1'	h m	Portata Q m³/h Capacity Q cu.m./h.	Mand. Press. gauge Hm. m.	Asp. Suction press. H m.	En. cin. Kin. En. $\Delta v^2$ 2g m.	Preval. Manom. totale T.H.D. HDT m.	NPSH m.	RISULTATI RAPPORTATI A FIGURES RELATED TO				giri/1' R.P.M.
									Q m³/h cu.m./h.	H HDT m.	Na Kw abs.	Potenza assorb. Na Kw abs.	
1	144	1.65	8782	11.8	1.60	1.41	14.51		90	13.6	508.9	559.3	720
2	144	0.86	6812	2.5		0.67	27.27		96	25.7	546.5	538.1	
3	144	0.78	5305	30.5		0.50	32.60		94.2	30.6	534.3	587.1	
4	144	0.67	5538	31.8		0.47	33.84		93.8	31.8	530.9	583.5	
5	144	0.51	1842	34.5		0.34	36.44		90.3	34.2	510	560.5	
6	144	0.76	3081	40		0.44	41.74		84	39.1	467.3	515.6	
7	144	0	0	42.2		-	43.80		66	41	347	382.9	
8													
9													

OSSERVAZIONI E RILIEVI  
REMARK AND NOTES

VIBRATIONS MAX $\mu$ (PK-PK)			
COUPLING SIDE		OPPOSITE COUPLING SIDE	
Flow	V	H	V
MAX	50	45	45
100%	40	40	35
80%	45	40	40
MIN	50	55	45

La prova è stata eseguita in presenza del Sig.

Test has been witnessed by

che dichiara di approvare i dati esposti per conto della Società  
who accepts the above figures on behalf of Messrs.

Contrassegni (item)

TOSHIBA DO BRASIL S.A. - CODEVASF

Per la Worthington  
Worthington

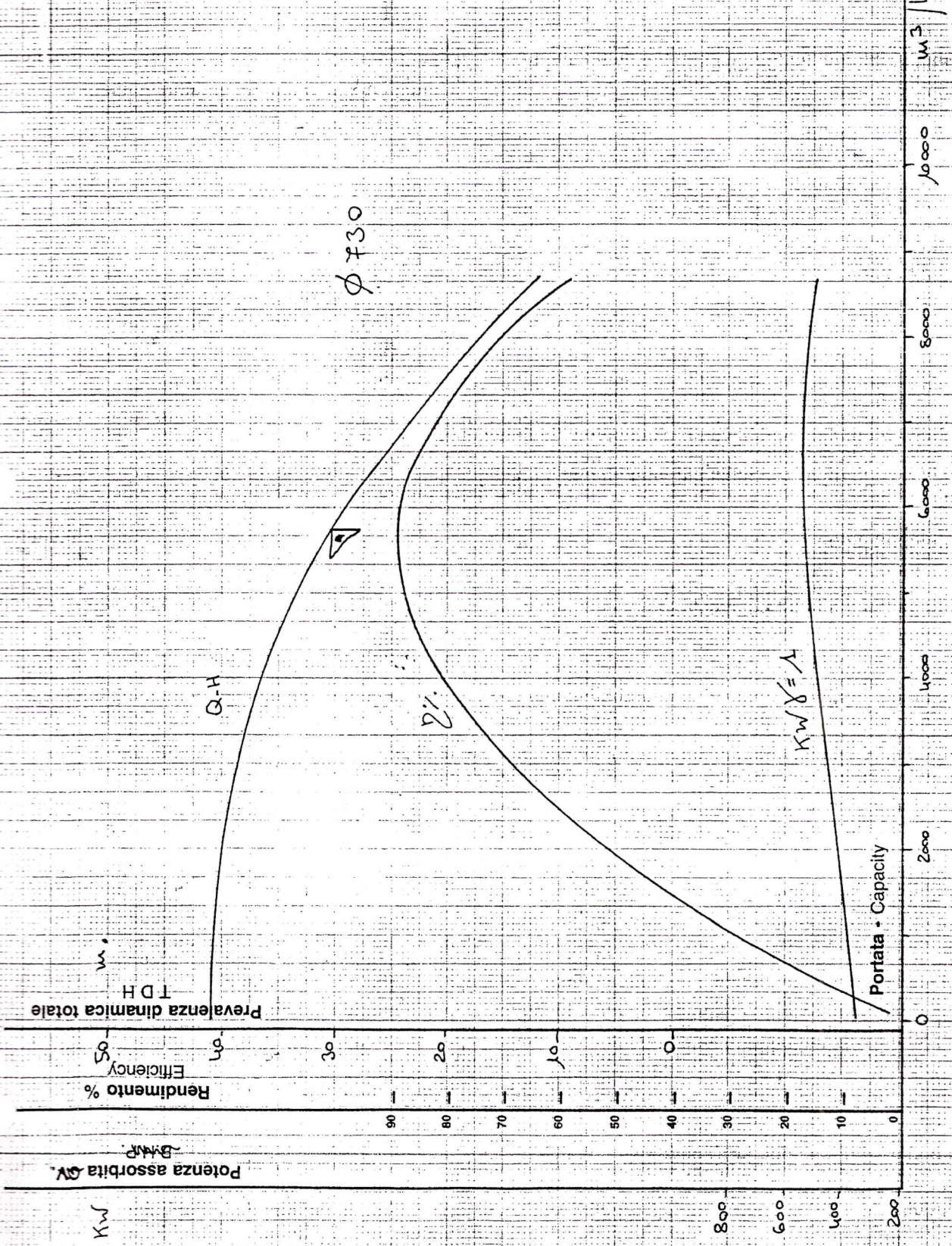
Per la Ditta Committente  
Customer's signature



This pump is guaranteed for the following C.O.S.

Portata mc/h  
Capacity GPM  
Preval. Din. Tot. m  
Tot. D.Y. n Head Ft  
Giri al primo  
RPM  
Rendimento  
Efficiency %  
Peso specifico  
Sp. GR.  
Viscosità  
Viscosity  
Fattore di correzione  
Factor for viscosity  
Temperatura di pomp. °C  
Pumping Temp. °F

Questa curva indica la prevalenza e i rendimenti presunti e diverse altre portate, ma questi dati supplementari, sono puramente indicativi e non garantiti.  
Le prestazioni indicate sono soggette alle tolleranze stabilite dall'Europump.  
This curve shows the expected heads and efficiencies at other capacities, but this additional data is only approximate and not guaranteed.  
Our performance data is subject to the Europump tolerances.



Data Date  
N. MC  
Curve

CURVA PER POMPA TIPO  
Size and Type  
32 QL 31  
η\* 46796

ORDINE N.  
Order  
POS.  
Item

PREVENTIVO N.  
Proposal



W.P.I. Worthington Pompe Italia spa  
DESIO





WORTHINGTON  
OMPE ITALIA SPA

CERTIFICATO di COLLAUDO

TEST CERTIFICATE N° C 32637

TIPO POMPA

TYPE OF MACHINE 32QL31

Matr.

Serial N° 46798

Ord.

10.02f35

L'azionamento è stato realizzato mediante motore elettrico

Type of electric motor used for test

accoppiato con giunto

Drive made through

MALHA

e/o riduttore - moltiplicatore

and/or reduction gear - over-gear

GUSTI 2:1

TEST ROOM

N° 17

HP-KW 1000 N/1

1480 Hz

50

V 6000 l

Tensione disponibile

Voltage available V

6000

Hz 50

Pressione barom.

Atm. pressure

m.

Vapour press.

m.

Misuratore di portata

Capacity measured with

VENTURIMETER

3534.5

venturimeter-diafragma:

Q = K - gauge tank:

Q = K -

Q = K -

Q = K -

Q = K -

Q = K -

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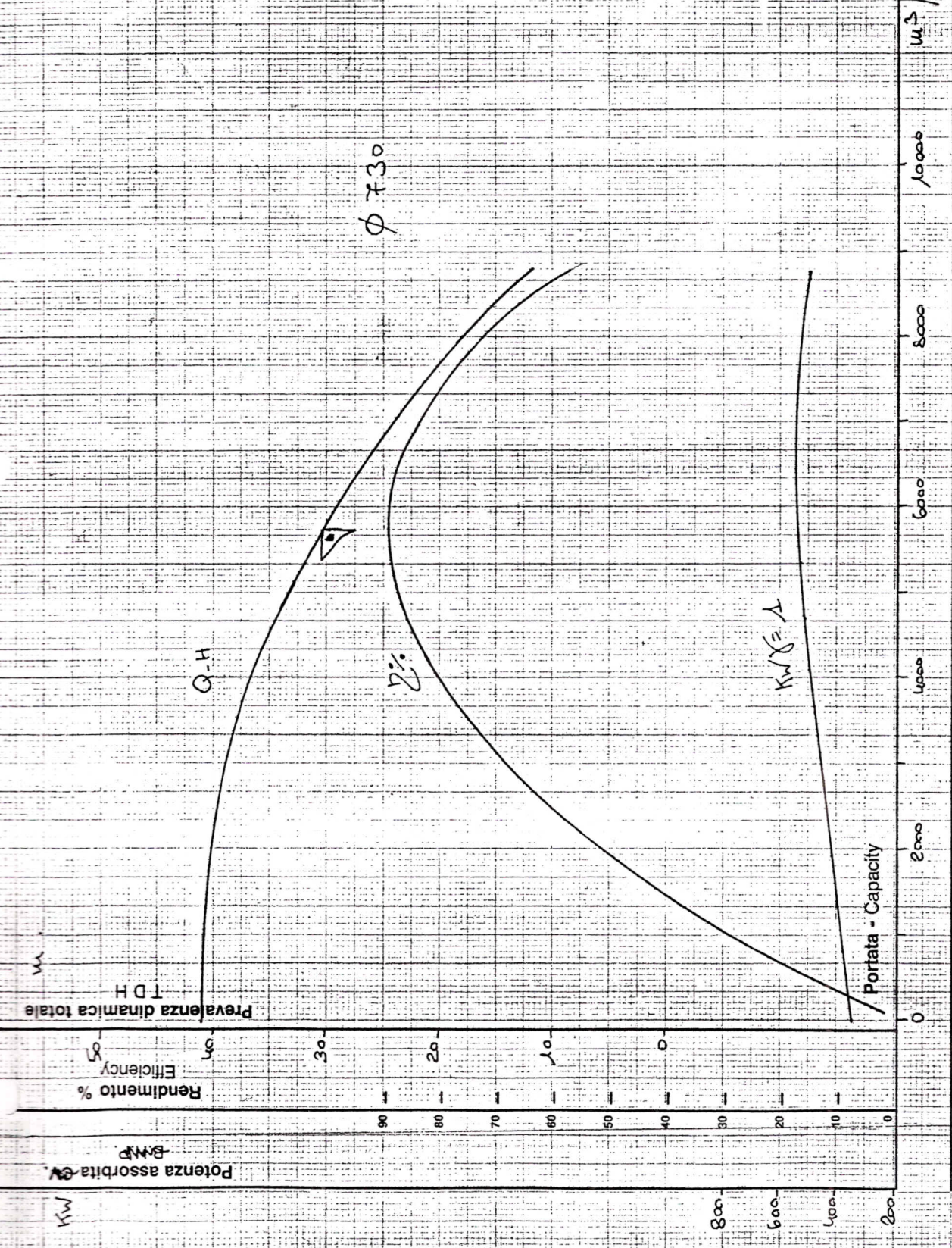


Questa pompa viene garantita per le seguenti C.O.S.  
This pump is guaranteed for the following C.O.S.

Portata mc/h  
Capacity 5160  
Preval. Din. Tot. m  
Tot. DYN Head 30.5  
Giri al primo  
RPM 720  
Rendimento  
Efficiency % 89.1  
Peso specifico  
Sp. GR. 1.00  
Viscosità  
Viscosity  
Fattore di correzione  
Factor for viscosity

Temp. di pomp. °C  
Pumping Temp. °F  
A 100

Questa curva indica la prevalenza e i rendimenti presunti e diverse altre portate, ma questi dati supplementari, sono puramente indicativi e non garantiti.  
Le prestazioni indicate sono soggette alle tolleranze stabilite dall'Europump.  
This curve shows the expected heads and efficiencies at other capacities, but this additional data is only approximate and not guaranteed.  
Our performance data is subject to the Europump tolerances.



Data Date  
7.10.88  
N. MC  
Curve C 32 637

CURVA PER POMPA TIPO  
Size and Type  
32 QL 31  
N° 46798

ORDINE N. 10-02735  
Order  
POS. Item

PREVENTIVO N.  
Proposal  
*[Signature]*

**Worthington**  
W.P.I. Worthington Pompe Italia spa  
DESIO







Potenza assorbita CV

Rendimento %

Prevalenza dinamica totale

W

Q-H

2"

KW  $\gamma = 1$

Portata - Capacity

$\phi 730$

NPSH m.



W.P.I. Worthington Pompe Italia spa  
DESIO

PREVENTIVO N.  
Proposal

*[Signature]*

ORDINE N. 10.02735  
Order

POS. Item

CURVA PER POMPA TIPO  
Size and Type

32 Q L 31  
4" 46799

Data 3-10-88  
Date

N.MC C 32636  
Curve

Capacità m<sup>3</sup>/h  
30.5  
Preval. Din. Tot. m  
Tot. D Y n. Head-Fe  
220  
Giri al primo  
R.P.M.  
89.1  
Rendimento  
Efficiency %  
1  
Peso specifico  
Sp. GR.  
Viscosità  
Viscosity  
Fattore di correzione  
Factor for viscosity  
Amb. Temperatura di pomp. °C  
Pumping Temp. °F

Questa curva indica la prevalenza e i rendimenti presunti e diverse altre portate, ma questi dati supplementari, sono puramente indicativi e non garantiti.  
Le prestazioni indicate sono soggette alle tolleranze stabilite dall'Europump.  
This curve shows the expected heads and efficiencies at other capacities, but this additional data is only approximate and not guaranteed.  
Our performance data is subject to the Europump tolerances.

5760

30.5

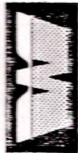
220

89.1

1

Amb.





WORTHINGTON  
POMPE ITALIA S.p.A.

Q.A.

Desio (Mi) 14-10-88  
Via Rossini, 90/92

## CERTIFICATO di COLLAUDO

### TEST CERTIFICATE N° C 32643

TIPO POMPA

TYPE OF MACHINE 32 Q 2 31

Matr.

Serial N° 46800

Ord. 10.02735

L'azionamento è stato realizzato mediante motore elettrico  
Type of electric motor used for test

accoppiato con giunto  
Drive made through

MATERIA

e/o riduttore - ~~motore~~  
and/or reduction gear - ~~over~~ gear

La prova è stata eseguita con acqua alla temperatura di  
Test has been carried out with water at a temperature of

Misuratore di portata  
Capacity measured with

VENTURIMETER ① K 3534.5  
② K 3534.5

venturimetro-diaframma:  
venturimeter-diaphragm:  $Q = K \cdot \sqrt{h}$  - gauge tank:  $Q = K \cdot \sqrt{h}$

cassone tarato:  $Q = K \cdot \sqrt{h}$

Tensione disponibile  
Voltage available V

Pressione barom.

Atm. pressure m. Tens. vap. m. Vapour press. m.

HP 1000 N° 17 Hz 50 V 6000 Hz 50

## DATI CONTRATTUALI

CONTRACT CONDITION OF SERVICE

N.	Velocità rotaz. n. giri/1'	h m	Portata Q. m³/h Capacity Q. cu.m./h.	Mand. Press. gauge Hm. m.	Asp. Suction press. H m.	En. cin. Kin. En. $\Delta v^2$ 2g m.	Preval. Manom. totale T.H.D. HDT m.	NPSH m.	RISULTATI RAPPORTATI A FIGURES RELATED TO				giri/1' R.P.M.
									Q m³/h cu.m./h.	H HDT m.	Na kW abs.	Potenza assorb. Na kW abs.	giri/1' R.P.M.
1	743	1.67	8853	11.5	1.60	1.13	14.23		90	44	557.2	8579	720
2		0.86	6812	25.9		0.67	28.17		95.5	48.5	538.1	6601	
3		0.76	5953	30.4		0.51	32.51		94	46.9	585.9	5768	
4		0.64	5473	31.9		0.43	33.93		92.8	46.5	579.2	5303	
5		0.49	4948	34.2		0.35	36.15		90.5	44.7	562.2	4795	
6	744	0.61	2936	40.5		0.12	42.22		84	40.5	517.7	2841	
7	744	-	-	42.4		-	44.00		66	27.5	385	-	
8													
9													

## OSSERVAZIONI E RILIEVI REMARK AND NOTES

La prova è stata eseguita in presenza del Sig.  
Test has been witnessed by

che dichiara di approvare i dati esposti per conto della Società  
who accepts the above figures on behalf of Messrs.

Contrassegni (item)

TOSHIBA DO BRASIL SA. COOEVASF

Per la Ditta Committente  
Customer's signature

Per la Worthington  
Worthington

VIBRATIONS MAX  $\mu$  (PK-PK)

COUPLING SIDE		OPPOSITE COUPLING SIDE	
Flow	V	H	V
MAX	52	49	49
100%	47	48	52
80%	45	39	44
MIN.	50	42	50





Portata m<sup>3</sup>/h  
 Capacity GPM  
 Preval. Din. Tot. m  
 Tot. D.Y. n. Head ft  
 Giri al primo  
 RPM  
 Rendimento  
 Efficiency %  
 Peso specifico  
 Sp. GR.  
 Viscosità  
 Viscosity  
 Fattore di correzione  
 Factor for viscosity  
 Temperatura di pomp. °C  
 Pumping Temp. °F

Questa curva indica la prevalenza e i rendimenti presunti e diverse altre portate, ma questi dati supplementari, sono puramente indicativi e non garantiti.  
 Le prestazioni indicate sono soggette alle tolleranze stabilite dall'Europump.  
 This curve shows the expected heads and efficiencies at other capacities, but this additional data is only approximate and not guaranteed.  
 Our performance data is subject to the Europump tolerances.

Data 14-10-88  
 Date  
 N. MC C-32643  
 Curve

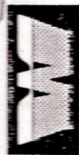
CURVA PER POMPA TIPO  
 Size and Type  
 32QL31  
 4246800

ORDINE N. 10-02735  
 Order  
 POS. Item

PREVENTIVO N. *[Signature]*  
 Proposal

**Worthington**  
 W.P.I. Worthington Pompe Italia spa  
 DESIO





WORTHINGTON  
POMPE ITALIA SPA

Q.A.

Desio (Mi) 19-10-88  
Via Rossini, 90/92

## CERTIFICATO di COLLAUDO

TEST CERTIFICATE N° C 32638

TIPO POMPA  
TYPE OF MACHINE

32 Q.L. 31

Matr.

Serial N° 46797

Ord

10-02735

L'azionamento è stato realizzato mediante motore elettrico  
Type of electric motor used for test

TEST ROOM

N°

17

HP

1000

N/1 1480

Hz 50

V 6000

accoppiato con giunto  
Drive made through

MAHA

~~riduttore~~  
and reduction gear - over gear

GIUSTI

2:1

Tensione disponibile  
Voltage available V 6000

Hz 50

Tens. vap.  
Vapour press.

La prova è stata eseguita con acqua alla temperatura di  
Test has been carried out with water at a temperature of

°C.

Misuratore di portata  
Capacity measured with

VENTURIMETER

① K 3534,5  
② K 3534,5

venturimetro-diaframma:  
venturimeter-diaphragm:

Q = K -  $\sqrt{h}$  - gauge tank: Q = K -  $\sqrt{t}$

casone tarato: Q = K -  $\sqrt{t}$

## DATI CONTRATTUALI

CONTRACT CONDITION OF SERVICE

N.	Velocità rotaz. n. giri/1' R.P.M.	h m	Portata Q. m³/h Capacity Q. cu.m./h.	Mand. Press. gauge Hm. m.	Asp. Suction press. H m.	En. cin. Kin. En. $\Delta v^2$ 2g m.		Preval. Manom. totale T.H.D. HDT m.	NPSH m.	RISULTATI RAPPORATI A FIGURES RELATED TO					giri/1' R.P.M.	Q cu.m./h					liquido liquid	RIVER WATER																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
						Q m³/h cu.m./h.	H HDT m.			Na kW abs.	Rend. motore Rg. Motor eff. η m%	W <sub>1</sub>	W <sub>2</sub>	η p Eff. %		Na kW	η p Eff. %	H <sub>or</sub> T.H.D. m.	° pompaggio pumping ° Amd ° C	p.s. sp. gr.			viscosità viscosity cS	Efficiency %	NPSH m	Curva MC Perfor. curve MC	FLANGIA SUCK nozzle Ø	FLANGIA DISCHARGE nozzle Ø	GIRANTE Ø IMPELLER Ø	DIS. DWG	MATER. MATERIAL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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## OSSERVAZIONI E RILIEVI REMARK AND NOTES

La prova è stata eseguita in presenza del Sig.  
Test has been witnessed by

che dichiara di approvare i dati esposti per conto della Società  
who accepts the above figures on behalf of Messrs.

Contrasegni (item)

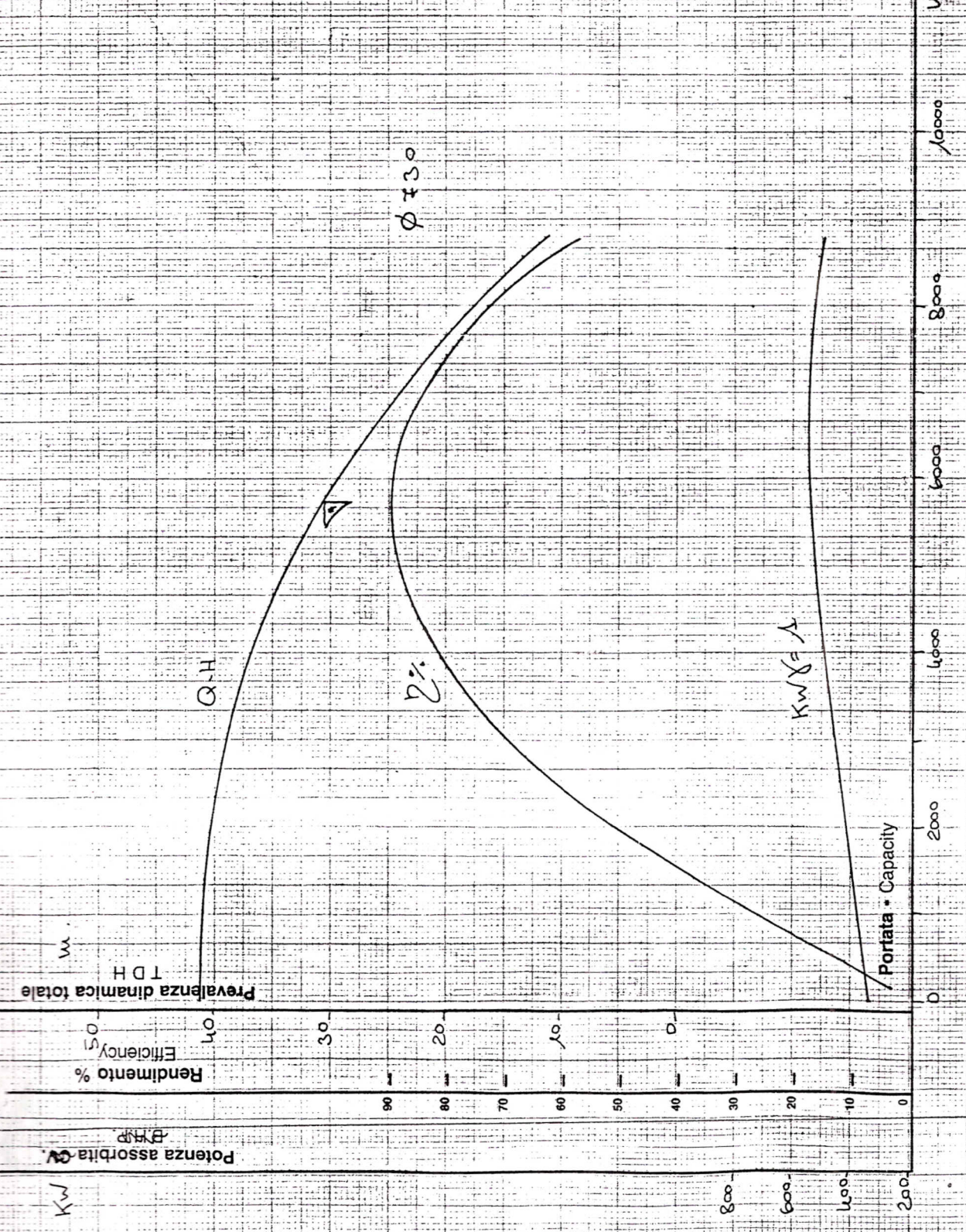
TOSHIBA DO BRASIL SA - CODEURSF



Questa pompa viene garantita per dare  
This pump is guaranteed for the following C.O.S.

5760 Portata mc/h  
Capacity 103.6 P.M.  
32.5 Preval. Din. Tot. m  
Tot. D.Y.n. Head ft  
720 Giri al primo  
R.P.M.  
89.1 Rendimento  
Efficiency %  
1.00 Peso specifico  
Sp. GR.  
Viscosità  
Viscosity  
Fattore di correzione  
Factor for viscosity  
Amb. Temperature di pomp. °C  
Pumping Temp. °F

Questa curva indica la prevalenza e i rendimenti  
presunti e diverse altre portate, ma questi dati  
supplementari, sono puramente indicativi e  
non garantiti.  
Le prestazioni indicate sono soggette alle tol-  
leranze stabilite dall'Europump.  
This curve shows the expected heads and effi-  
ciencies at other capacities, but this additional data  
is only approximate and not guaranteed.  
Our performance data is subject to the Europump  
tolerances.



Data 19-10-88  
Date  
N. MC C 32638  
Curve

CURVA PER POMPA TIPO  
Size and Type  
32 QL 31  
η = 46797

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Order  
POS. Item

PREVENTIVO N. *[Signature]*  
Proposal

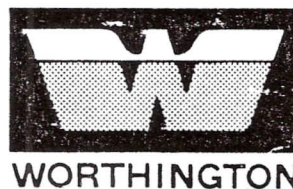


W.P.I. Worthington Pompe Italia spa  
DESIO



**INSTRUCTIONS FOR  
INSTALLATION, OPERATION,  
AND MAINTENANCE,  
AND LIST OF PARTS**

**VERTICAL DOUBLE SUCTION PUMP  
(TYPE QL)**





## FOREWORD

Worthington products are the result of more than a century of progressive study and development. Advanced design, proper selection of materials, and precision construction reflect this wide experience. Worthington products will give trouble-free efficient operation with minimum maintenance and repair.

This instruction book will familiarize management and operating personnel with pertinent details and proper procedures for the installation, operation, and maintenance of one of these products.

Designate below your identification of the equipment for which this book applies.

UNIT SIZE	IDENTIFICATION NO.

### NOTE

Bowl serial number is stamped on discharge case flange.

## STUDY THIS INSTRUCTION BOOK

The descriptions and instructions included in this book cover the standard design of the equipment and any common deviations when possible. This book does not cover all design details and variations nor does it provide for every possible contingency which may be encountered. When information cannot be found in this book, contact the nearest Worthington District Office.

Do not operate this equipment in excess of its rated

speed, pressure and temperature, nor otherwise than in accordance with the instructions contained in this Manual. This equipment (or a prototype) has been shop tested and found satisfactory for the conditions for which it was sold, but its operation in excess of these conditions will subject it to stresses and strains which it was not designed to withstand.

Failure to heed this warning may result in an accident causing personal injury.



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## SECTION I INTRODUCTION AND GENERAL DESCRIPTION

### 1-1. INTRODUCTION.

1-2. Worthington Vertical Double Suction Pumps are designed primarily for installation in sumps or shallow pits.

### 1-3. GENERAL DESCRIPTION.

1-4. Basic components of the pump are the driver, the discharge head, the column pipe, and the pump element.

### 1-5. DRIVER UNIT.

1-6. Driver units are supplied in a variety of types and sizes to meet a wide range of operating requirements. Hollow shaft, medium thrust, or solid shaft, normal thrust, electric motors are most commonly used. Internal combustion engines or horizontal turbines, coupled by right-angle gear drives, are occasionally used to drive the pumps. Hollow shaft motors and right-angle drive units are installed over the pump top shaft extension. The top shaft is coupled to the driver by a key and adjusting nut at its upper end. Flanged adjustable couplings are used with solid shaft drivers.

### 1-7. PUMP HEAD.

1-8. The pump head is a rigid casting or fabricated steel structure, which supports the pump and driver on the foundation. On above ground discharge installations, the pump head provides a discharge opening and flange which couples to the discharge piping. Accessory equipment is supplied for oil lubricated pumps. A steel reservoir mounted on the pump head holds a supply of lubricant for the bearings. Proper lubrication is maintained by a manual valve or electrically operated solenoid valve and sight feed oil valves. Low pressure clear water may be used as a lubricant where the use of oil is not feasible.

### 1-9. COLUMN PIPE.

1-10. The column pipe extends from the underside of the pump down to the pump element. An interior shaft tube encloses the shaft, supports the line-shaft bearings and serves as a conductor for the lubricant.

### 1-11. PUMP ELEMENT.

1-12. The pump element is designed to operate submerged in the liquid. It consists of a suction bell, impeller, pump shaft, and casing.

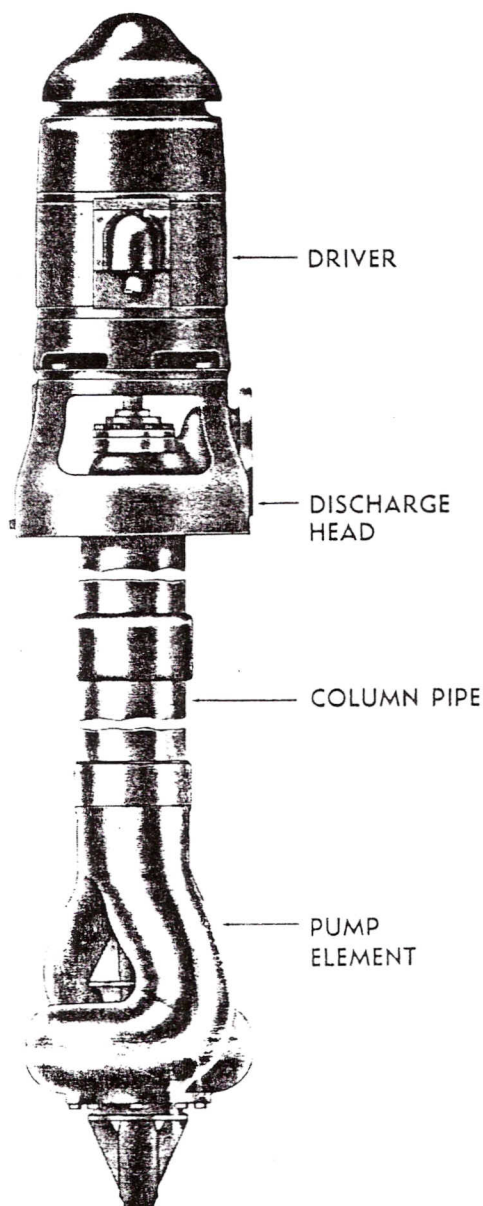


Figure 1-1. Type QL Pump



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1-13. The suction bell serves as the input port to the lower half of the impeller. Internal vanes support the housing of the suction bell bearing. Tubing, extended down from the discharge head, supplies lubricant to the bearing.

1-14. The casing is an integral casting of the suction bell for upper half of impeller, twin volute to efficiently convert to pressure the velocity added

to liquid by the impeller, and a transition section to couple the volute to the column. It also contains the upper suction bell bearing and connector bearing to couple to the shaft enclosing tube.

1-15. Impellers are of the enclosed double suction centrifugal type keyed to the shaft and axially located by corrosion resistant retaining rings.

## SECTION II PRE-INSTALLATION

### 2-1. INSPECTION OF EQUIPMENT.

2-2. All parts should be inspected upon receipt for damaged or missing components. Any deficiency should be reported to the local agent of the company responsible for transporting the equipment.

#### NOTE

Components, parts and accessory parts are sometimes placed in shipping containers in individual packages. Thoroughly inspect all wrappings and crates for attached parts before discarding.

### 2-3. STORAGE.

2-4. The unit is shipped in condition for immediate

installation. If interim storage of the unit is required, carefully select storage space so that the unit is not subject to excessive moisture, extreme weather conditions, corrosive fumes, or other harmful storage conditions. If the duration of storage is expected to be extensive, the unit should be examined from time to time and cleaned when required.

### 2-5. CLEANING PRIOR TO INSTALLATION.

2-6. Flush the pump thoroughly with clean water before installing. Remove any rust spots from machined surfaces with a fine grade of emery cloth. Clean all threaded surfaces and attaching hardware of dirt or grease.

## SECTION III INSTALLATION

### 3-1. SHORT COUPLED PUMP.

3-2. If the pump is short enough to be safely handled by normal carrier equipment and if sufficient head room is available, it will be shipped completely assembled except for the driver and lubrication accessories.

### 3-3. LONG COUPLED PUMP.

3-4. If the pump length or other considerations preclude factory assembly it will be shipped as separate components: discharge head, required lengths of column and pump element.

### 3-5. LOCATION OF EQUIPMENT.

3-6. Place the pump where it is easily connected to a simple discharge piping arrangement, and is accessible for periodic inspection. There should be

ample head room to allow the use of an overhead crane or other lifting device with sufficient capacity to handle the assembled pump and the pump driver individually.

### 3-7. FOUNDATION.

3-8. The foundation may consist of any material that will afford permanent, rigid support to the full area of the pump supporting member and will absorb expected stresses and shocks that may be encountered in service.

3-9. Concrete foundations should be level and built on solid ground. Foundation bolts of the specified size should be located according to the pump template drawing. Each bolt should be surrounded by a rigidly held pipe sleeve two to three times the diameter of the bolt to allow the bolts to align with the holes in the base plate.



3-10. When the pump unit is mounted directly on structural steel framing, it should be located directly over or as near as possible to the main building members, beams, or walls. The baseplate should be bolted to the steel supports to avoid distortion, prevent vibration, and retain proper alignment.

### 3-11. EQUIPMENT REQUIRED FOR INSTALLATION.

3-12. Equipment required for installation includes:

- Foundation nuts and bolts, when necessary.
- Leveling apparatus such as, wedges, or shims.
- Suitable derrick, tripod, or crane with chain hoist or similar equipment having a hook and swivel.

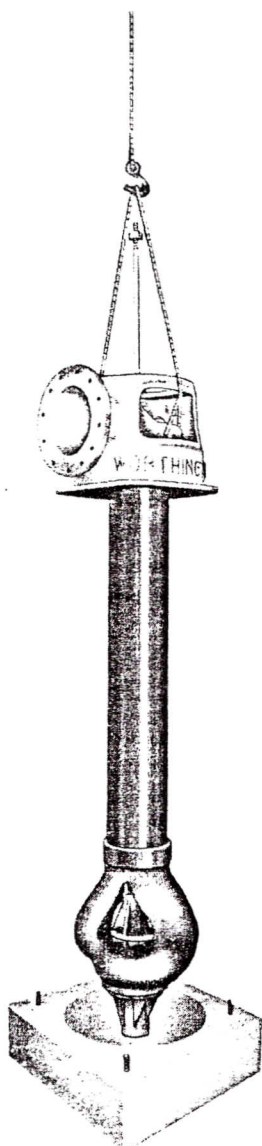


Figure 3-1. Short Coupled Pump Installation

### 3-13. INSTALLATION.

3-14. Before commencing with the installation, it is recommended that a qualified electrical contractor be engaged to arrange connection of electrical controls and protective devices for the motor and to make electrical connections to the motor after it is installed.

#### CAUTION

Clean all debris and loose materials from the sump before making the pump installation.

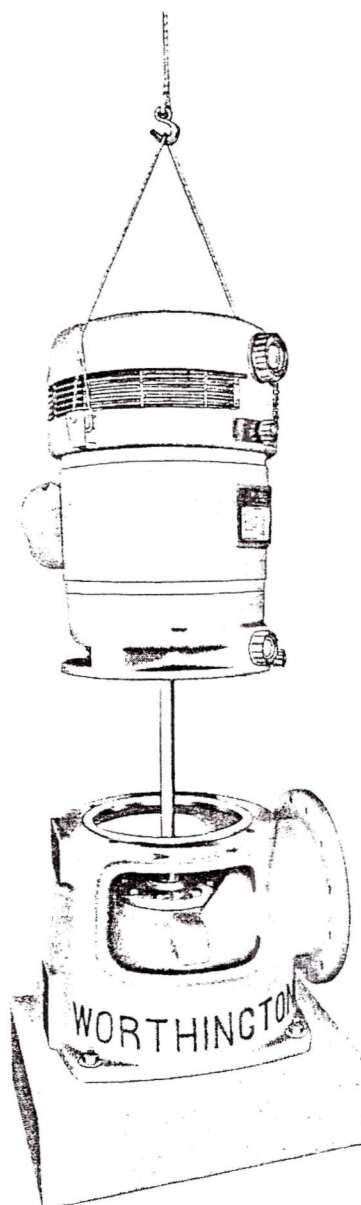


Figure 3-2. Hollow Shaft Motor Installation



**NOTE**

Before proceeding, measure and record axial movement of pump shaft of complete unit or pump element. The movement is approximately one quarter inch.

**3-15. SHORT COUPLED PUMP INSTALLATION.**

- a. Cover the foundation opening with a sheet of plywood or other material to avoid dropping anything into the pit or sump.
- b. Position lifting device with hook and swivel centered over foundation opening.
- c. Attach a sling to pump head lifting hooks.
- d. Attach sling to the lifting device hook.
- e. Lift pump until lower end is free of ground or floor (figure 3-1).
- f. Remove cover from foundation opening.
- g. Slowly lower pump, guiding lower end through foundation opening.
- h. Rotate pump until discharge head faces proper direction to mate with discharge piping, and pump mounting holes align with foundation mounting holes.
- i. Hand guide pump column pipe as it passes through foundation opening to make certain that it meets with no obstruction. Any obstruction the pump may strike can be felt in this manner.
- j. Seat pump on foundation and level, using shims if necessary to compensate for any foundation irregularities.
- k. Remove sling from pump.

**3-16. HOLLOW SHAFT MOTORS.**

- a. Remove clutch from motor.
- b. Attach sling to motor.
- c. Lift motor and center over pump top shaft.
- d. Slowly lower motor onto pump head (figure 3-2) making certain that mounting holes in motor and pump head are aligned.

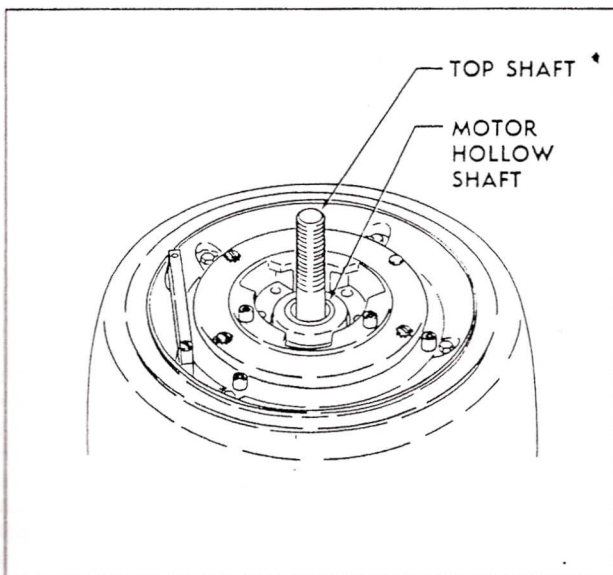


Figure 3-3. Top Shaft Centering

e. Remove sling from motor and remove hoisting equipment.

f. Bolt motor to pump head, and bolt pump head to foundation.

g. Connect discharge piping to pump, being careful to align piping with pump discharge to avoid placing any stress on pump. Support piping independently of pump.

h. Check that top shaft is in center of motor hollow shaft (figure 3-3). Shim between pump head and foundation if necessary to center top shaft and insure that motor rotates in the proper direction by momentarily starting motor.

i. Install motor clutch on top shaft with key, and secure clutch to motor shaft.

j. Install adjusting nut on top shaft (figure 3-4) and lightly tighten until it bears on motor clutch and slack is removed from shaft. Then continue to tighten nut until impeller reaches upper stop. Check axial movement against previously recorded measurement. Back off adjusting nut to lower impeller one half of axial movement. This locates the impeller centrally in the volute. Proper impeller location is necessary for correct balance and thrust in the pump.

k. Insert and tighten set screw in adjusting nut.

l. Raise shaft centering collar and press firmly against end of motor hollow shaft. Tighten set screws holding collar to shaft.

m. Bolt mounting bracket and oiler tank to side of pump head.

n. Connect manual or solenoid valves, sight feed oil valves, and lubricator fittings to oiler tank.

o. Connect lubricator fittings to tension bearing, and suction bell tubing.

**3-17. SOLID SHAFT MOTORS.**

- a. Install the driven half of motor coupling on pump top shaft.

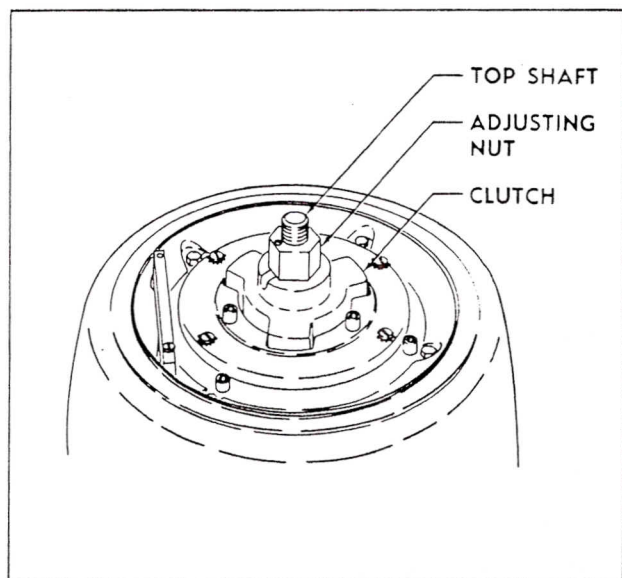


Figure 3-4. Adjusting Nut Installation



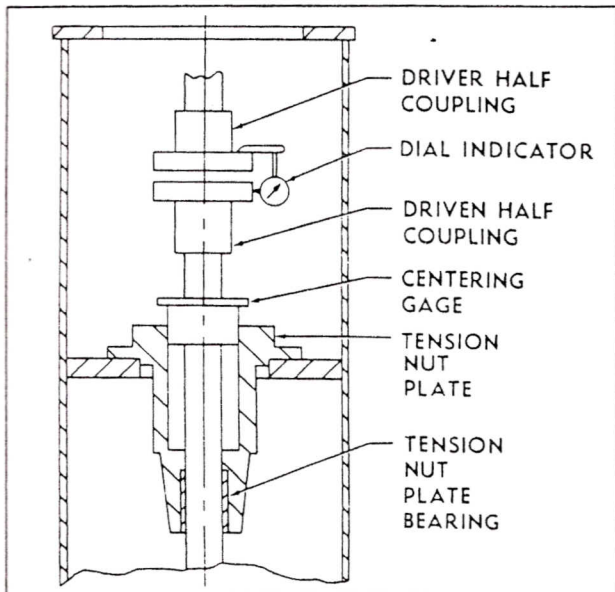


Figure 3-5. Centering Gage

- b. Install the driver half of motor coupling on motor shaft.
- c. Attach sling to motor.
- d. Lift motor and center over pump shaft.
- e. Slowly lower motor onto pump head, making certain that mounting holes in motor and pump head are aligned.
- f. Using a straight edge, check that two halves of coupling are aligned.
- g. Bolt motor loosely to pump head.
- h. For pumps of standard construction insert several strips of shim stock approximately .003" thick between shaft and tension bearing to center and steady the shaft. For pumps with auxiliary stuffing box, remove packing and gland and insert centering gage in tension nut plate (figure 3-5).
- i. Clamp dial indicator to spacer or driver half of coupling.
- j. Indicate to driver half of coupling.
- k. Rotate motor shaft by hand.
- l. Tighten motor mounting bolts if shaft alignment is within 0.001 inch. If shafts are not aligned, reposition motor and align shafts then tighten mounting bolts.
- m. Remove sling from motor and remove hoisting equipment.
- n. Rotate adjusting nut on pump shaft until space between coupling halves is one half of previously recorded axial movement. Check that motor rotates in proper direction by momentarily starting motor.
- o. Tighten socket head cap screw in adjusting nut. Make certain that screw engages pin hole in adjusting nut.
- p. Securely tighten all coupling bolts.

### 3-18. LONG COUPLED PUMP INSTALLATION.

19. Before commencing with the installation, it is recommended that a qualified electrical contractor be engaged to arrange connection of electrical

controls and protective devices for the motor and to make electrical connections to the motor after it is installed.

#### CAUTION

Clean all debris and loose materials from the well before making the pump installation.

### 3-20. ENCLOSED LINESHAFT PUMP INSTALLATION.

- a. Cover the foundation opening with a sheet of plywood or other material to avoid dropping anything into well.
- b. Position hoisting equipment with hook and swivel centered over foundation opening.
- c. Attach a pipe clamp at the upper part of pump element and lift until it centers over foundation opening.
- d. Lower pump element until clamp rests on foundation.
- e. Remove plugs from ends of preassembled lineshaft and enclosing tube and pull lineshaft out approximately 8 inches.
- f. Insert the lineshaft and enclosing tube in a length of column pipe and allow the end with the protruding lineshaft to extend approximately 1 ft.
- g. Using a rope, take two half hitches around lineshaft, two half hitches around enclosing tube, and then two half hitches around column pipe (figure 3-2).
- h. Clamp column pipe just below coupling.
- i. Attach sling to clamp on column pipe and lift until lower end centers over pump element.
- j. Slowly lower column pipe, lineshaft, and enclosing tube until lineshaft can be coupled to pump shaft. Remove thread protector.
- k. Remove rope from lineshaft, place a small amount of oil on lineshaft threads, and turn lineshaft counterclockwise to couple with pump shaft.

#### CAUTION

Be sure shaft ends are clean before assembling.

- l. Remove rope from lineshaft enclosing tube and column pipe and turn enclosing tube counterclockwise to couple to discharge case connector bearing.
- m. Lower column pipe and turn clockwise to couple to pump element.
- n. Strap or tape, suction bell bearing lubrication tubing to column pipe.
- o. Lift column pipe and pump element slightly and remove clamp from pump element.
- p. Lower column pipe and pump element until clamp on column pipe rests on foundation.
- q. Install a column pipe spacer in column pipe, and check that stickup dimension from top of spacer to top of lineshaft is 15-1/2 in.
- r. Check that stickup dimension from top of enclosing tube to top of lineshaft is 9-1/2 in.



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s. Pour a small amount of oil into the enclosing tube during installation of each section to assure adequate lubrication of the lineshaft bearings for initial startup. See lubrication instructions in Section V for correct oil to be used.

t. Install a lineshaft bearing into protruding enclosing tube. Use non-hardening thread compound on all lineshaft bearing threads.

u. Place small amount of oil on lineshaft thread; then install a coupling on protruding end of lineshaft, making certain that coupling is centered.

### NOTE

Install column pipe spiders at 30-foot intervals for 1" shafts and at 50-foot intervals for 1-1/4" shafts.

v. Repeat steps i through u until pump element is lowered to proper depth in well.

w. If pump discharge is to be located below ground, install discharge tee at proper location.

x. Connect pump top shaft to lineshaft.

y. Connect top shaft enclosing tube to lineshaft enclosing tube.

z. Invert pump head, center top column flange gasket on bottom of pump head, and bolt flanged top column pipe to bottom of pump head.

### NOTE

During assembly of top column pipe flange to bottom of pump head, check to make sure gasket is centered and pipe is in alignment after assembly.

aa. Attach a sling to pump head lifting hooks.

ab. Lift pump head with attached top column pipe, remove thread protector and lower over top shaft (figure 3-3).

ac. Rotate top column pipe and pump head clockwise to screw top column pipe into column pipe coupling.

ad. Lift complete pump slightly and then remove pipe clamp.

ae. Rotate pump until discharge head or underground tee faces proper direction to mate with discharge piping, and until pump mounting holes align with foundation mounting holes.

af. Seat pump on foundation and level, using shims if necessary, to compensate for any foundation irregularities.

ag. Remove sling from pump.

ah. Insert "O" ring in groove inside the tension nut

plate and lower tension nut plate over top shaft.

ai. Center tension nut plate over top shaft enclosing tube and slowly lower carefully, allowing "O" ring and tension nut plate to slide down the outside of the upper shaft enclosing tube.

aj. Bolt tension nut plate to discharge head.

ak. Lower tubing tension bearing over top shaft and rotate counterclockwise into upper shaft enclosing tube until hand tight. Then tighten approximately 1 to 1-1/2 turns per 100 ft. of pump length to properly tension the enclosing tube.

### NOTE

On enclosed lineshaft water lubricated pumps, additional packing, gland, and gland nuts must be assembled. (See figure 6-3.)

al. Line up set screw hole in tension bearing with nearest tapped hole in top of tension nut plate. Then insert set screw and tighten.

am. Bolt mounting bracket and oiler tank to side of pump head.

an. Connect manual or solenoid valves, sight feed oil valves, and lubricator fittings to oiler tank.

ao. Connect lubricator fittings to tension bearing, and suction bell tubing.

3-21. DRIVER INSTALLATION. Refer to sections 3-16 and 3-17.

3-22. GROUTING.

3-23. Grouting prevents lateral shifting of the pump discharge head but does not take up foundation irregularities. Grout the pump as follows:

a. Construct a wood form around pump discharge head to contain grout.

b. Mix grout by using one part portland cement and two parts building sand with sufficient water to form a thin paste.

c. Wet foundation thoroughly with water and pour grout into the wood form, making certain the mixture flows freely under the pump discharge head.

d. Using a stiff wire, work the grout to release any air pockets.

e. Cover exposed grout surface with wet burlap to effect slow drying.

f. After grout has set 48 hours, remove wood forms and smooth exposed surface. Allow grout to set a total of 72 hours before starting pump.

## SECTION IV OPERATION

4-1. PRE-STARTING.

4-2. Before starting the pump, check that:

a. The discharge valve is partially open and the discharge piping is properly connected.

b. The impellers have been properly adjusted during installation and the motor shaft and pump rotate freely.

c. All bolts are tight.

4-3. STARTING.

4-4. Start the pump as follows:

a. Close the starting switch.

b. Observe that the pump starts easily and runs



without excessive vibration. If there is starting difficulty or excessive vibration, stop the pump immediately and refer to Section V to determine the probable cause.

c. Slowly open the discharge valve until the discharge pressure reaches the desired value or the valve is fully open.

#### 4-5. FINAL ADJUSTMENT.

4-6. After the pump has run long enough to tighten

any slack left in the lineshaft couplings and clear the pumped liquid of abrasives, the impellers position should be checked and readjusted to place it at center of axial movement.

#### 4-7. STOPPING.

4-8. Close the discharge valve slowly then shut off the motor. This will prevent surges in the system and avoid liquid backflow through the pump.

## SECTION V MAINTENANCE

### 5-1. PREVENTIVE MAINTENANCE.

#### 5-2. INSPECTION.

5-3. Vertical double suction pumps are designed for long trouble-free service with a minimum amount of attention. Periodically inspect the oiler for proper functioning and oil supply, and the pumps for loose bolts, excessive vibration, dirt and corrosion.

#### 5-4. CLEANING.

5-5. Remove rust or corrosion with a fine wire brush and rags. If necessary, clean all parts, except electrical contacts, by moistening the cloth or brush with a suitable solvent.

5-6. LUBRICATION. The enclosed lineshaft pumps normally have oil lubricated pump and lineshaft bearings. Lubricant for these bearings is contained in the lubricating oil tank and fed into the adjuster bearing. Keep the lubricating oil tank filled with a good quality light turbine oil of about 150 SSU at the pumped liquid temperature. A heavier oil may not flow properly through the bearings. Set the oilers to feed 4 to 6 drops per minute into the shaft tube and 3 to 4 drops per minute to the suction bell bearing.

### 5-7. CORRECTIVE MAINTENANCE.

#### 5-8. TROUBLESHOOTING.

5-9. PUMP DOES NOT START. Failure of the pump to start may be caused by:

- a. Low voltage supplied to the pump motor.
- b. Electrical circuit open or not completed.
- c. Defective motor.
- d. Pump forced into a crooked hole or against an obstruction in the hole or sump.
- e. Impeller binding against pump case because of maladjustment or bearing wear.

5-10. PUMP DOES NOT DELIVER LIQUID. Failure of the pump to deliver liquid may be caused by:

- a. Low pump speed caused by low line voltage or frequency.

- b. Incorrect direction of rotation.
- c. Total pumping head may exceed pump design head.

5-11. INSUFFICIENT CAPACITY. The capacity may not be sufficient because:

- a. Low pump speed caused by low line voltage or frequency.
- b. Total pumping head may exceed pump design head.
- c. Liquid lines or pump strainer may be partially clogged.
- d. Loose impeller.
- e. Air or vapor entering the suction head.
- f. Liquid level in well or sump too low.

5-12. PUMP LOSES PRIME AFTER STARTING. The pump may lose its prime after starting if the liquid level falls below the pump suction. This may occur when the quantity of liquid supplied for pumping is less than the capacity of the pump.

5-13. PUMP OVERLOADS MOTOR. The pump may overload the motor because:

- a. Motor speed too high because of high line voltage or frequency.
- b. Operation at point on curve other than design.
- c. Liquid pumped is not of the specific gravity for which the pump was designed.
- d. Low line voltage or defective motor.
- e. Impeller rubbing on top or bottom.

5-14. PUMP VIBRATES. Pump vibration may be caused by:

- a. Worn bearings.
- b. Misaligned or bent lineshaft.
- c. Loose mounting bolts or foundation not rigid.
- d. Impeller corroded or partially clogged causing unbalance.
- e. Air or vapor entering suction head.
- f. Stress due to piping misalignment.

5-15. CORROSION. Corrosion may be caused by impurities in the water, or by the type of liquid pumped. Corrosion can be minimized by using stainless steel, bronze or monel metal parts which can be furnished to suit special needs.



## WORTHINGTON

5-16. ENCLOSED LINESHAFT PUMPS. Repair of enclosed lineshaft pumps consists of removal of the pump and disassembly to the point necessary for replacement of defective parts. Hoisting equipment, such as that described for installation, is required to pull the pump from the well. Remove and disassemble the pump as follows:

- a. Remove electrical power from motor and disconnect and tag electrical leads at the motor. This should be done by a qualified electrician.
- b. Remove the cover from the top of motor and remove adjusting nut lock screw (2, figure 6-2) and adjusting nut (1, figure 6-2) from upper end of top shaft.
- c. Remove motor clutch.
- d. Remove bolts (457) that secure motor to discharge head (7).
- e. Attach a sling to motor lifting eyes and lift the motor vertically until it clears the top shaft.
- f. Provide a suitable support and lower motor on it.

### NOTE

Be sure to provide a clean area with sufficient room to lay parts out in the order in which they are removed.

- g. Disconnect oil line from shaft tube tension nut (63).

### NOTE

On enclosed lineshaft water lubricated pumps, (figure 6-3) additional packing, and packing gland must be removed before removing tubing tension nut.

- h. Remove set screw holding tubing tension nut to tension nut plate (17E) and remove tubing tension nut by turning it clockwise.
- i. Remove tension nut plate by removing the securing bolts (458).
- j. Disconnect discharge piping from pump.
- k. Remove bolts that secure pump to foundation.
- l. Attach a sling to pump lifting hooks and lift pump vertically until column pipe is exposed.
- m. Clamp column pipe below first coupling and lower pump until clamp rests on foundation.

- n. Disconnect top column pipe from column pipe coupling by rotating counterclockwise.

- o. Lift pump head and top column pipe. Then remove top shaft and top enclosing tube.

- p. Lift column pipe until next coupling (24) is exposed.

- q. Clamp column pipe below coupling and lower column pipe until clamp rests on foundation.

- r. Disconnect column pipe at coupling and lift column pipe to expose enclosing tube (51) joint.

- s. Using a rope, secure enclosing tube to column pipe.

- t. Disconnect enclosing tube at coupling and lift column pipe with enclosing tube until lineshaft (23) coupling is exposed.

- u. Using the rope, secure lineshaft to enclosing tube and column pipe.

- v. Disconnect lineshaft.

- w. Lower column pipe, enclosing tube, and lineshaft onto a suitable support.

- x. Disassemble individual sections of lineshaft and enclosing tube.

- y. Disconnect additional lengths of column pipe, enclosing tube, and lineshaft by repeating steps k through s until pump element is reached.

- z. Disconnect pump element and position horizontally for disassembly.

- aa. Disassemble pump element as described in paragraph 5-17.

5-17. PUMP ELEMENT. To dismantle the pump element, (figure 6-6) remove shaft coupling (31), remove bolts (407) from lower suction bell and remove bell (40). The shaft (32) and impeller (38) are then withdrawn from the casing (36). Loosen set screws and remove sand collars (37). Remove locating rings (408) and push shaft (32) out of impeller.

5-18. BEARING AND WEAR RING CLEARANCES. All bearings have a nominal total clearance of .008". A  $\pm .002$ " variation is within acceptable limits for new or rebuilt pumps. Factory wear ring clearances vary slightly depending on basic diameter. When repairing pumps it will be satisfactory to maintain a clearance of .014" to 0.18" for all sizes covered by this manual.

## SECTION VI

### LIST OF PARTS

#### 6-1. GENERAL.

6-2. The requirement for a stock of spare parts will vary with the severity of conditions of service, the extent of field maintenance anticipated, and the number of units installed. A minimum of one spare of each moving part should be stocked, as well as a complete set of bearings and seals.

#### 6-3. ORDERING PARTS.

6-4. When ordering spare and replacement parts the pump serial number, size and type of pumps must be given. Refer to the nameplate. This information is essential in order that the Worthington Corporation may identify the pump and furnish the correct repair parts. Give the name and number of the part as listed in the parts list of the sectional



drawing applicable to the pump (figures 6-2, 6-3, 6-4 and 6-5), and pump element (figure 6-6), the quantity required and where possible, the complete symbols stamped on the old part. Orders for replacement parts should be sent to the nearest Worthington District Office.

#### 6-5. RETURNING PARTS.

6-6. All materials returned to the factory must have a Returned Apparatus (RA) tag (figure 6-1) attached. Consult the nearest District Office or Regional Engineering and Service Office for shipping instructions and an RA tag. Unnecessary delays are avoided when parts or equipment are returned to the proper factory using the correct procedure.

a. Contact your nearest District Office or R.E. & S. Office, listing the material to be returned and the reasons for returning it.

b. On receipt of the RA tag, fill in the tag and post card (attached) as shown below. Make sure you give the name and parts list number of parts involved and the serial number of the equipment. Give the method and date of shipment on the post card.

c. Detach the post card and mail it directly to the factory designated by your nearest Worthington District or R.E. & S. Office. This will notify the Service and Erection Department that such material is enroute. The card should be at the factory before the arrival of the material.

d. The RA tag must accompany the material shipped. Enclose it in the shipping container or attach it to the part being returned. In cases where more than one part or box is returned print or stencil your name the name of the part and the RA tag number on each part or box, attaching the tag to one of the parts. This will facilitate quick identification.

e. Articles being returned should be carefully packed to prevent damage from handling or from exposure to weather.

WORTHINGTON CORPORATION		WORTHINGTON CORPORATION	
RETURNED APPARATUS		RETURNED APPARATUS	
Tag No. 124709		Tag No. 124709	
R. M. 1428		R. M. 1428	
We have shipped material (listed below) covered by your order D.O.P. 11967		We have shipped material (listed below) covered by your order D.O.P. 11967	
To: Worthington Corporation, Vertical Pump Division		To: Worthington Corporation, Vertical Pump Division	
Address: 4751 Broadway, Denver 16, Colorado		Address: 4751 Broadway, Denver 16, Colorado	
Date of Shipment _____		Date of Shipment _____	
Prepaid Via Express <input type="checkbox"/> P. P. <input type="checkbox"/> Freight <input type="checkbox"/>		Prepaid Via Express <input type="checkbox"/> P. P. <input type="checkbox"/> Freight <input type="checkbox"/>	
For Credit <input type="checkbox"/> For Repair <input type="checkbox"/> For Mounting <input type="checkbox"/> As Sample <input type="checkbox"/>		For Credit <input type="checkbox"/> For Repair <input type="checkbox"/> For Mounting <input type="checkbox"/> As Sample <input type="checkbox"/>	
Works: Denver VP Office Chicago Authorized by: BFC		Works: Denver VP Office Chicago Authorized by: BFC	
Material: 1 - Topshaft, 1-1/4" x 45'		Material: 1 - Topshaft, 1-1/4" x 45'	
Shipped By: J. P. Doe Company		Shipped By: J. P. Doe Company	
Address: 845 Smith Street, Chicago, Illinois		Address: 845 Smith Street, Chicago, Illinois	
THIS TAG TO BE ATTACHED TO ARTICLE BEING RETURNED Do Not Use As Shipping Tag		THIS CARD TO BE DETACHED AND MAILED	

Figure 6-1. Returned Apparatus Tag



APPENDIX TO STANDARD INSTRUCTION AND MAINTENANCE MANUAL  
FOR QL PUMPS

Centering Electric Motors

Page 4 Paragraph 3-17 Solid Shaft Motors

The procedure of centering when mounting electric motors is not applicable, if actual drivers are made available at the pump manufacturing works before shipment.

The procedure outlined in the manual will then be a one-time internal shop procedure. At the pump factory the motor will be either centered by its own centering rim on the motor support or if no centering edge on motor flange is available centering dowels will be fitted.

This means in the field no special centering procedure is to be followed.

N.B. : A check must nevertheless be made to detect possible misalignment caused by damage.

Enclosed Lineshaft Pump Installation

Page 5 Paragraph 3-20

Long pumps are being shipped in component form. Subject paragraph indicates the procedure of assembling/installing long pumps by method of fitting section by section, while the pump is hanging vertically in the pit.

The necessity of following this method, however, only applies when no hoisting device with total pump length capability is available.

If, however, a suitable crane can be used, the pump can be assembled on a horizontal surface.

In the process care must be given to properly support the equipment. Suitable supports must be placed under pump bowl and discharge head. As for the column it is best to place supports at every 15 ft. (5 meters) maximum.

After complete assembly (electric motor to be mounted when pump hanging in pit) the pump can be lifted to a vertical position and carefully lowered into the pit.

When tilting the pump from a horizontal plane, special care must be taken to protect the lower suction bell from being damaged.

When the pump is properly fitted onto the supporting beams, the electric motor can be mounted.



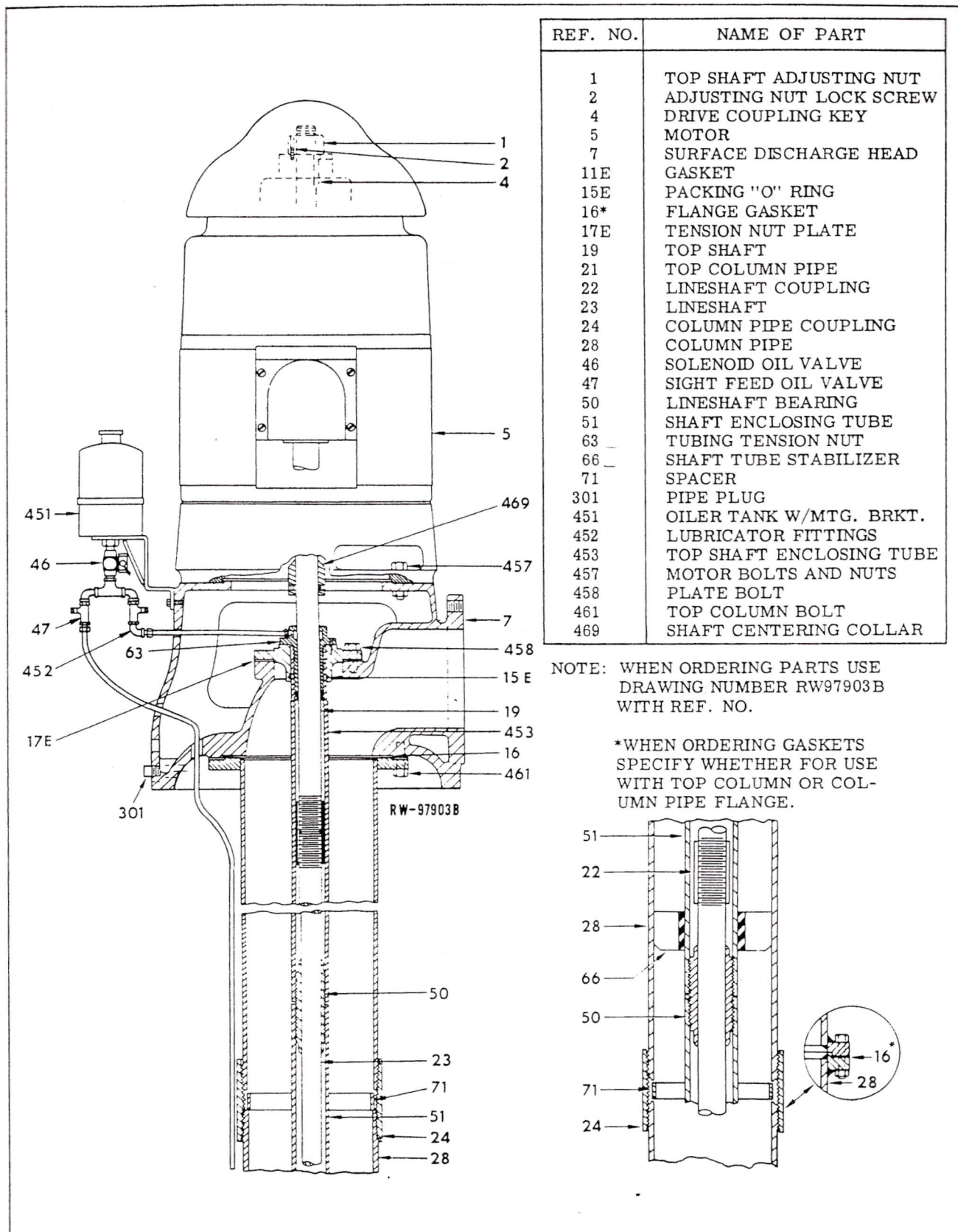


Figure 6-2. Enclosed Lineshaft Pump and List of Parts



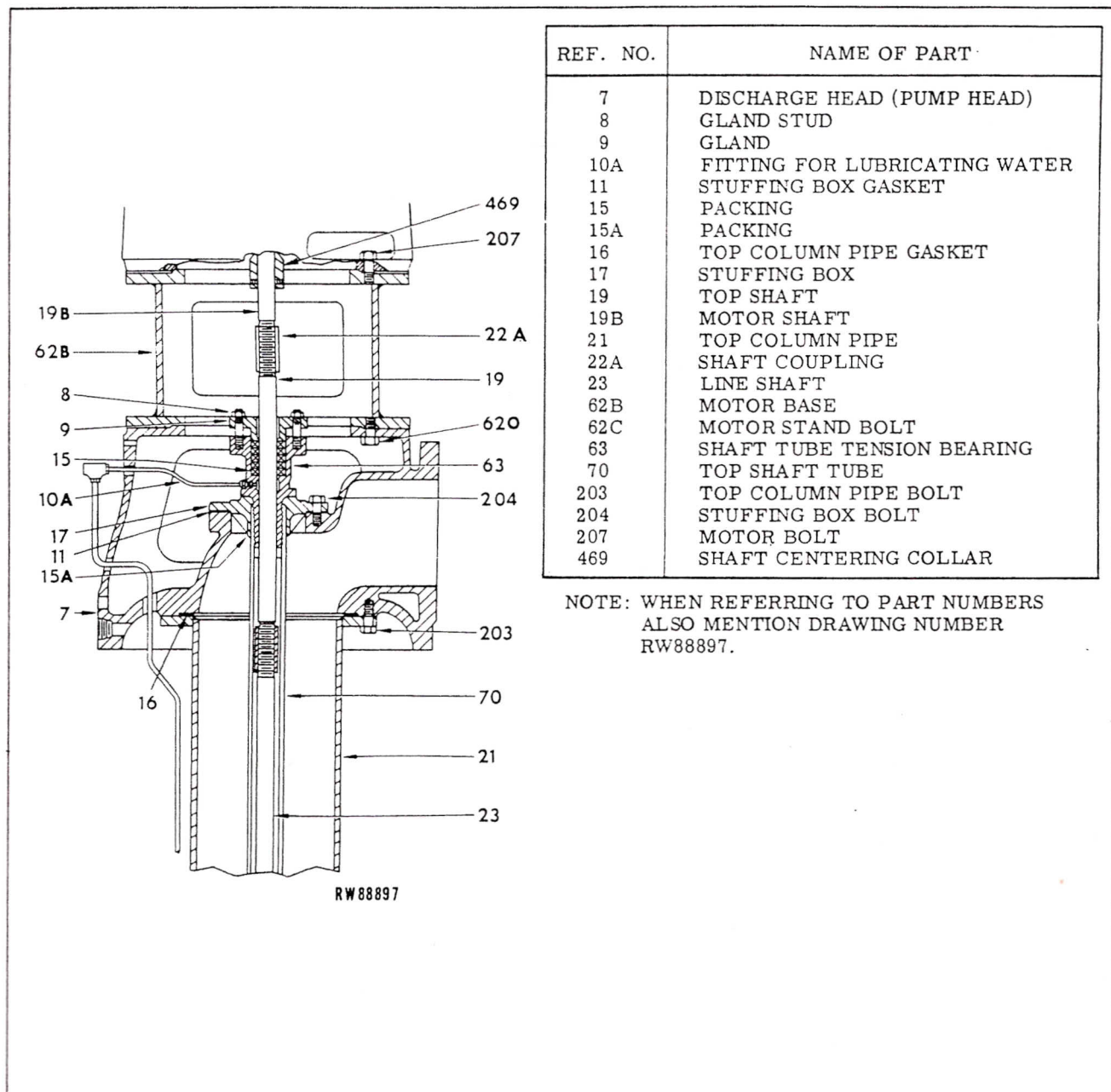


Figure 6-3. Enclosed Lineshaft Water Lubricated Pump and List of Parts



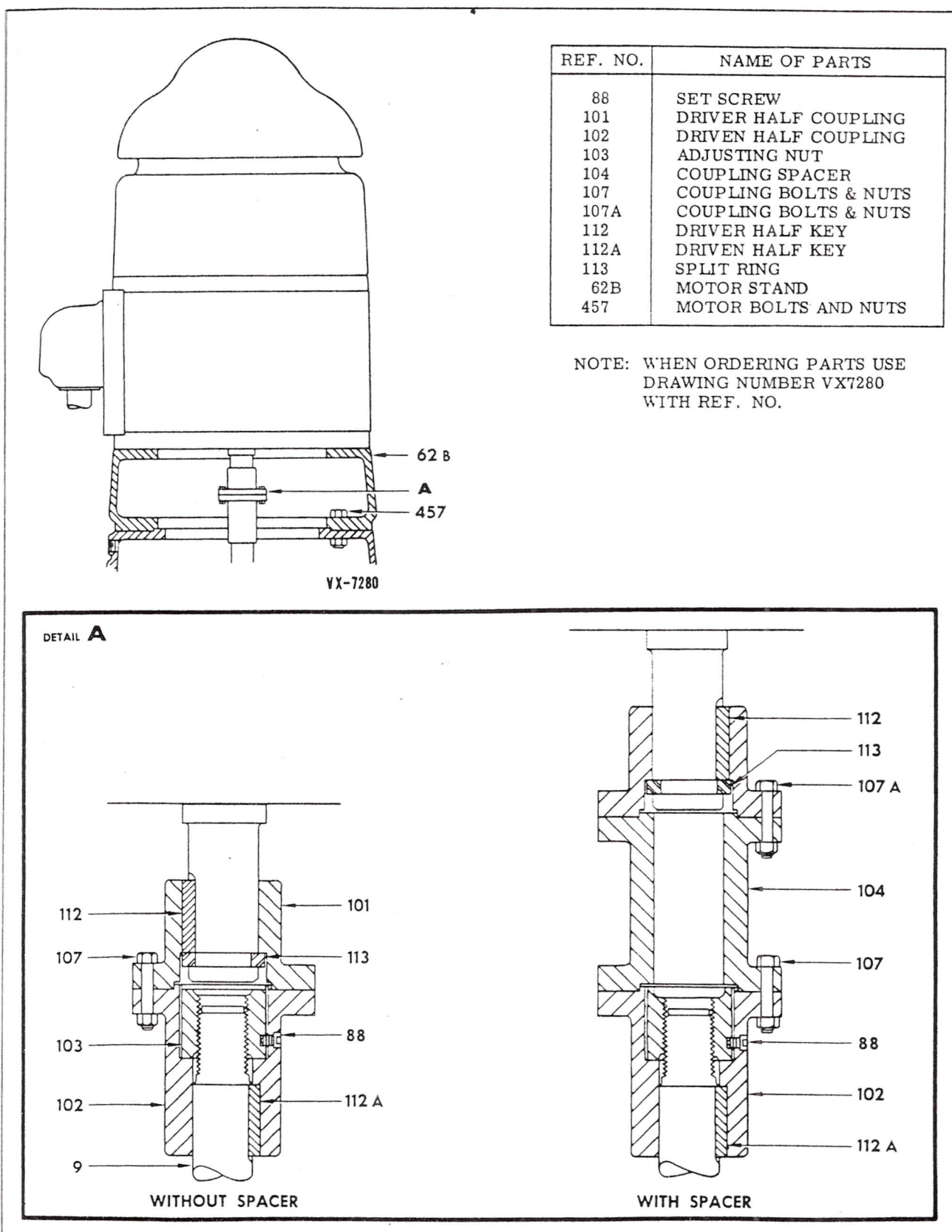
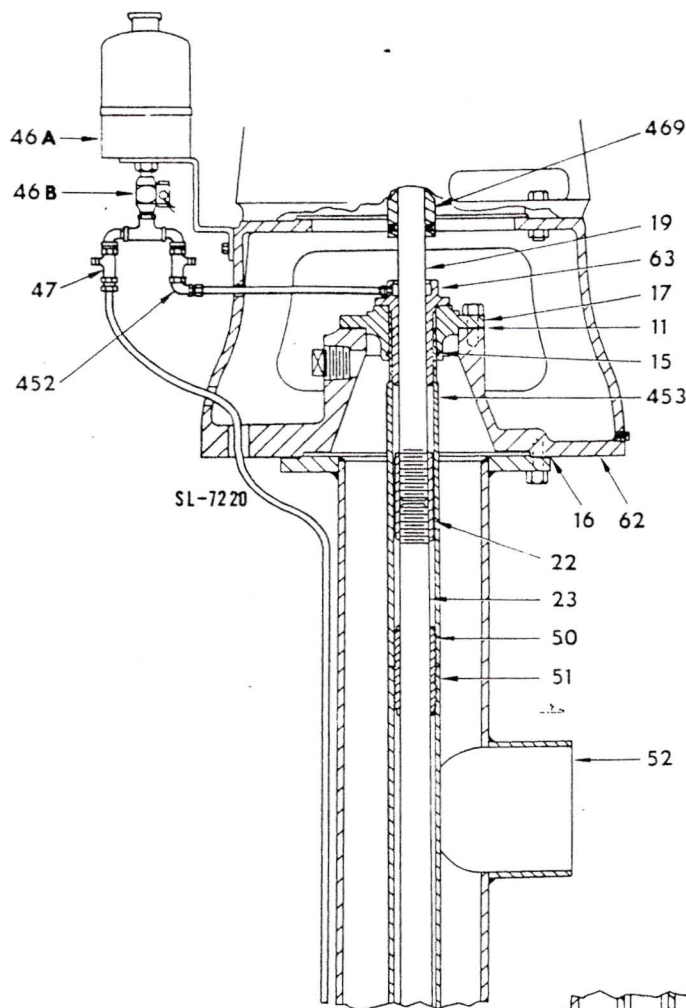


Figure 6-4. Flanged Adjustable Coupling

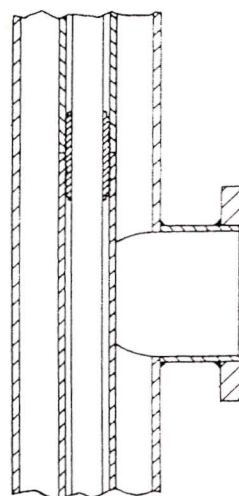




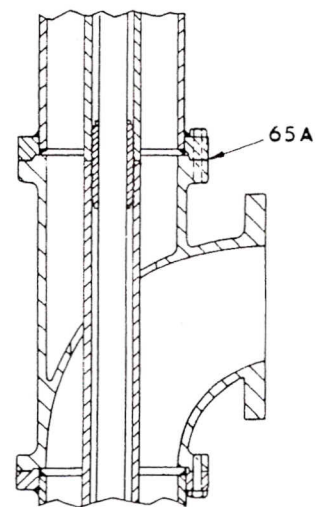
REF. NO.	NAME OF PART
11	GASKET
15	PACKING "O" RING
16	TOP COLUMN PIPE GASKET
19	TOP SHAFT
22	SHAFT COUPLING
23	LINE SHAFT
46A	OILER TANK
46B	SOLENOID
47	SIGHT FEED VALVE
50	LINE SHAFT
51	BEARING ENCLOSED
52	SHAFT TUBE
52	DISCHARGE ELBOW
62	MOTOR BASE
63	TENSION BEARING
65A	COLUMN PIPE GASKET
452	LUBRICATOR FITTINGS
453	TOP SHAFT TUBE
469	SHAFT CENTERING COLLAR

NOTE: WHEN REFERRING TO PART NUMBERS ALSO MENTION DRAWING NUMBER SL-7220.

STYLE 'A' (STEEL)



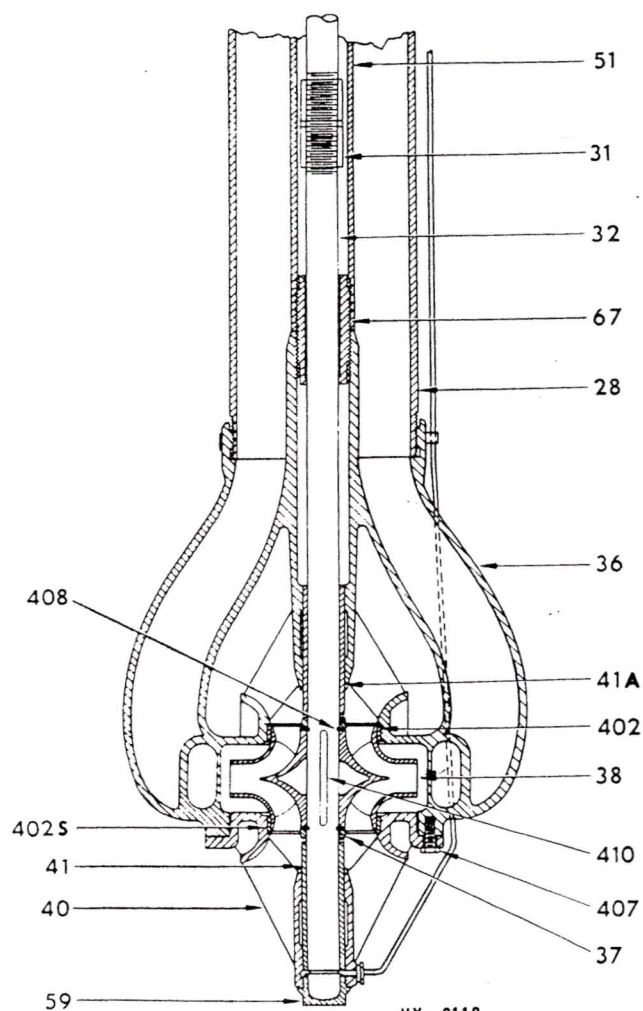
STYLE 'B' (STEEL)



STYLE 'C' (CAST IRON)

Figure 6-5. Below Ground Discharge Enclosed Lineshaft Pump and List of Parts





REF. NO.	NAME OF PART
28	COLUMN PIPE
31	PUMP SHAFT COUPLING
32	PUMP SHAFT
36	CASING
37	COLLAR W/SET SCREWS
38	IMPELLER
40	SUCTION BELL
41	SUCTION BELL BEARING
41A	CASING BEARING
51	SHAFT ENCLOSING TUBE
59	SUCTION BELL PLUG
67	CONNECTOR BEARING
402	CASING WEAR RING
402S	SUCTION BELL WEAR RING
407	CASING BOLTS
408	LOCATING RING
410	IMPELLER KEY

NOTE: WHEN REFERRING TO PART NUMBERS ALSO MENTION DRAWING NUMBER VX-9112.

Figure 6-6. Pump Element and List of Parts



WORTHINGTON  
POMPE  
ITALIA S.p.a.

LIST OF COMPONENT PARTS FOR CENTRIFUGAL PUMP  
TYPE: 32 QL 31

DWG.EM.185658

CODEVASF PROJETO FORMOSO A  
ESTACAO DE BOMBEAMENTO PRINCIPAL  
BOMBAS PRINCIPALS  
DE IRRIGACAO  
W.P.I. REF. 10-02735

Sh. 1 of 2

ITEM	DESCRIPTION	Q	MATERIALS (ASTM)
17003	FLAT GASKET <sup>JUNTA</sup> ✓	2 ✓	ASBESTOS
004	FLAT GASKET ✓	1	ASBESTOS
009	KEY	1	A276-316
009a	KEY	6	A276-316
010	COUPLING KEY	1	A276-316
010a	COUPLING KEY	1	A276-316
017	O RING ✓	1	RUBBER
018	O RING ✓	4	RUBBER
019	O RING ✓	7	RUBBER
020	O RING ✓	2	RUBBER
021	O RING ✓	1	RUBBER
025	LIP SEAL RING ✓	2	RUBBER
026	RETAINING RING ✓	5	S.S. 18/8
028	PARALLEL PIN	3	STEEL
028a	PARALLEL PIN	1	STEEL
202	DISCHARGE BOWL	1	A48 CL 35
202a	VOLUTE CASING	1	A48 CL 35
207	SUCTION CASE	1	A48 CL 35
207a	SUCTION CASE	1	A48 CL 35
223	CASING WEAR RING	1	B584-C905
223a	CASING WEAR RING	1	B584-C905
224	IMPELLER WEAR RING	1	B584-C905
224a	IMPELLER WEAR RING	1	B584-C905
229	IMPELLER	1	B584-C905
231	SHAFT	1	A276-316 <sup>AI SI</sup>
* 234	BUSHING (BAIXO MOTOR)	1 ✓	B584-C938
* 234a	BUSHING (SUP. MOTOR)	1 ✓	B584-C938
* 234b	BUSHING (CONEXÃO SEMI-ELIXOS)	1 ✓	B584-C938
* 234c	BUSHING (CONEXÃO 3º SE COM VOLUME)	3 ✓	B584-C938
237	CAP	1	A48 CL 35
238	HALF COUPLING	1	A576-1030
238a	HALF COUPLING	1	A576-1030
926	COLUMN	1	A106GrB/A285GrC
926a	COLUMN	2	A106GrB/A285GrC
930	SHAFT ENCLOSING TUBE COUPLING	3	A48 CL 35
931	COLUMN SHAFT	2	A276-316
934	SPLIT LOCATING RING	2	A276-316
934a	SPLIT LOCATING RING	1	A576-1030
935	PROTECTING COLLAR	2	A273-316

feita de conexão ao bombeamento



! WORTHINGTON !  
! POMPE !  
! ITALIA S.p.a. !

! LIST OF COMPONENT PARTS FOR CENTRIFUGAL PUMP !  
! TYPE: 32 QL 31 !

! DWG.EM.185658 !

! Sh. 2 of 2 !

! ITEM DESCRIPTION Q MATERIALS (ASTM) !

! 951 WELDED DISCHARGE HEAD !

! 953 STUFFING BOX !

! \*955 BUSHING (Proximo ao motor) !

! 956 TOP SHAFT !

! 958 SHAFT COUPLING (REVERSÍVEL AJUSTÁVEL) !

! 964 ADJUSTING NUT !

! 965 SPLIT COLLAR !

! 1 ! A106GrB/A285GrC !

! 1 ! A48 CL 35 !

! 1 ✓ ! B584-C938 !

! 1 ! A276-316 !

! 3 ! A276-316 !

! 1 ! A576-1030 !

! 3 ! A276-316 !




CUSTOMER : CODEVASF

PLANT : "A" PROJECT IRRIGATION

SITE INSTALLATION : FORMOSO

WORTHINGTON REF. : 10/02735

PUMP TYPE : 32 QL 31

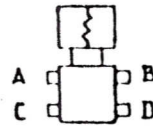
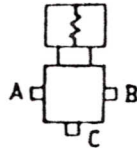
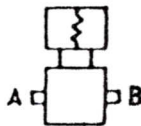
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Luc.	Visto			
INSTRUMENT SPECIFICATION		 <b>Worthington</b> W.P.I. Worthington Pompe italia spa DESIO		
		N.		
		SE. IDS.001A/10.02735		
JOB	DATE	REV.	Sheet	of
10.02735	25.05.1988	0	1	3

QTY	TAG.N.	DESCRIPTION
		<div>FUNCTION</div> <div>           PRESSURE GAUGE            DIFFERENTIAL PRESSURE GAUGE            PRESS. DIFF. PRESSURE SWITCH            DIAL THERMOMETER            DIAL THERMOM. WITH CONTACTS            TEMPERATURE SWITCH            SIGHT GLASS            FLOW INDICATOR            LEVEL SWITCH - LEVEL GAUGE - LEVEL CONTR.            PRESSURE CONTROL VALVE            FLOW CONTROL VALVE            TEMPERATURE CONTROL VALVE            PNEUMATIC CONTROL VALVE            PRESSURE SAFETY VALVE            SOLENOID VALVE            ORIFICE            SPEED CONTROLLER         </div>
		SHEET
		3



**VALVOLE A SOLENOIDE**  
**Solenoid valves**

REV 0



REV	POS	TIPO Type		2 VIE 2 way	<input checked="" type="checkbox"/>	3 VIE 3 way	<input type="checkbox"/>	4 VIE 4 way	<input type="checkbox"/>
2		CLASSIFICAZIONE AREA Area classification						CERTIFICATO Certificate	
3		ALIMENTAZIONE ELETTRICA Power supply						220 VOLTS 60 Hz	
4		VALVOLA A 2 VIE - IN MANCANZA ENERGIA ELETTRICA 2 way valve - on electric failure						DC <input type="checkbox"/> AC <input checked="" type="checkbox"/>	
5		VALVOLA A 3/4 VIE - SOLENOIDE ENERGIZZATO 3/4 way valve - Solenoid energized						APERTA Open	
		SOLENOIDE DISERGENIZZATO Solenoid de energized						CHIUSO Closed	
6		SIGLA Tag No						SV 100 ÷ 105	
7		SERVIZIO Service						SOLENOID OILER	
8		FLUIDO Fluid						OIL	
9		COMPOSTI CORROSIVI Corrosive agents							
10		TEMPER. NORM. Operat. temperat.						MAX °C	
11		PRESS. NORM. Operat. pressure						MAX	
12		PESO SPECIFICO COND. RIFER. Specific gravity - Refer. condit.							
13		PESO SPECIFICO COND. ESERC. Specific gravity - Operat. condit.							
14		PESO MOLECOLARE Molecular weight							
15		VISCOSITA' Viscosity							
16		PORTATA NORM. Normal flow						MAX	
17		Δ P CALCOLO Δ P sizing						MAX	
18		TENDITA PERFETTA Tight shut off							
19		PROVA IDRAULICA Hydraulic test							
20		CV CALCOLATO Calculated CV						CV SELEZION. Selected CV	
21		DIMENS. CORPO Body size						DIMENS. SEDE Port size	
22		CONNESSIONI E RATING Rating & connections						1/4" NPT	
23		MATERIALE CORPO Body material						BRASS	
24		MATERIALE SEDE Seat material						AISI	
25		MATERIALE PADERNA Packing material							
26		AZIONATA DA PILOTA Pilot operated							
27		PIATTINO MANUALE Manual reset							
28		OPER. MANUALE Manual operator							
29									
30									
31		COSTRUTTORE E MODELLO Mfr. & model No						CLIMATIC - EYSI 6	

TROPICALIZZAZIONE  
Tropicalization

UMIDITÀ  
Humidity

TEMPERATURA AMBIENTE  
Ambient temperature

°C MIN

°C MAX

NOTES

RIF. Rel. SPEC. EMESSA DA Issued by

0 EMISSIONE -

DESCRIZIONE - Description

DeSR  
COMP.

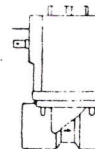
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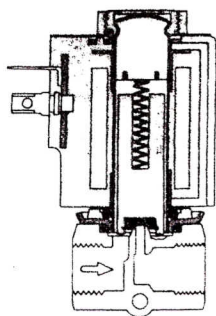
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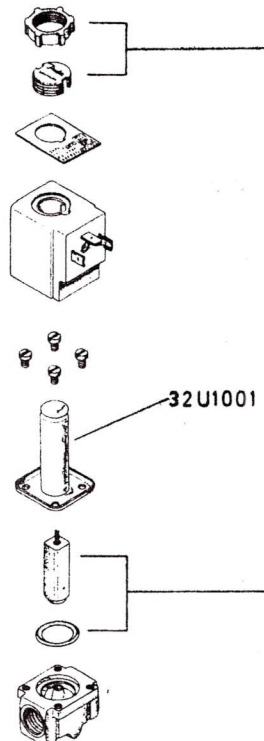
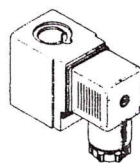


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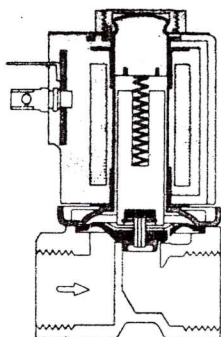
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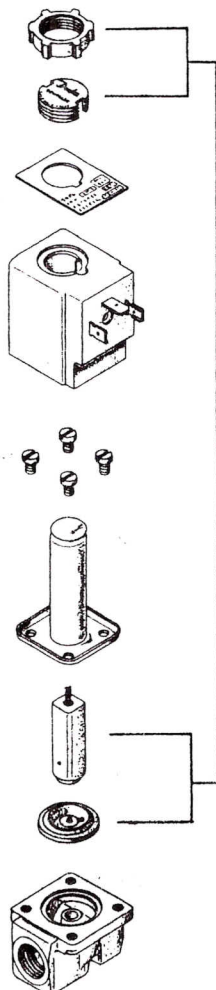
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DANFOSS  
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EVSI 6W — 32U1062

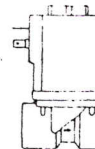
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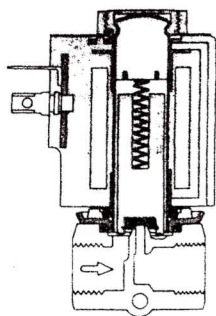
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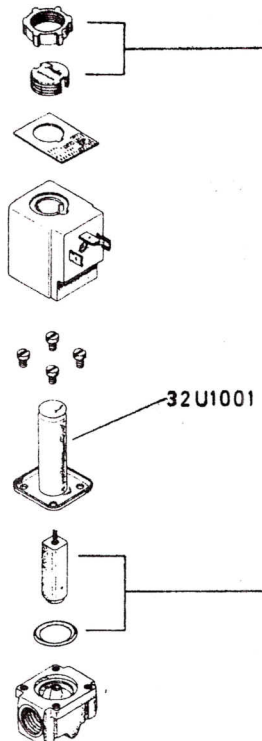
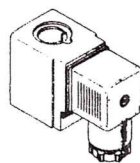


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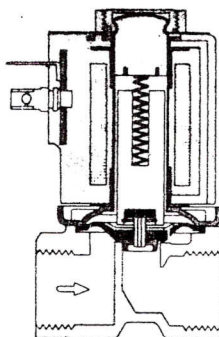
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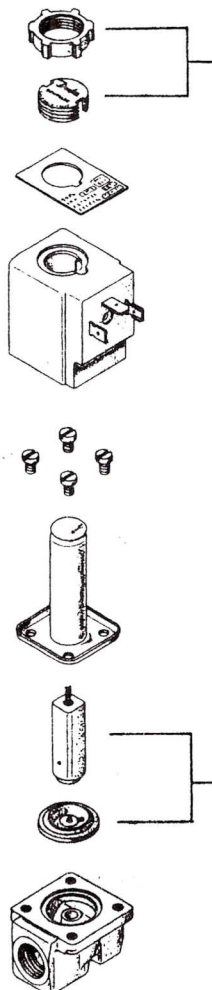
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Type EVI 1.5 - 3



DANFOSS  
32U8711

DANFOSS  
32U8713/3



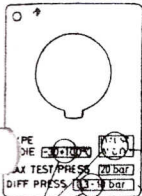
EVSI 6W — 32U1062

EVSI 6 OL — 32U1063

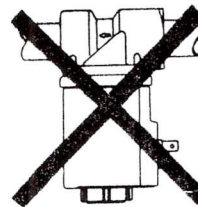
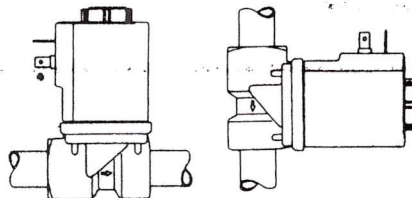
EVSI 10W — 32U1065

EVSI 10 OL — 32U1066

Type EVSI 6 - 10

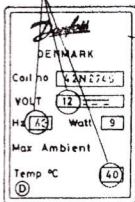


O	L	W
OLIE	LUFT	VAND
OIL	AIR	WATER
ÖL	LUFT	WASSER
L'HUILE	L'AIR	L'EAU
ACEITE	AIRE	AQUA
OLIO	ARIA	AQUA
OLIE	LUCHT	WATER
OLJY	ILMA	VESIR

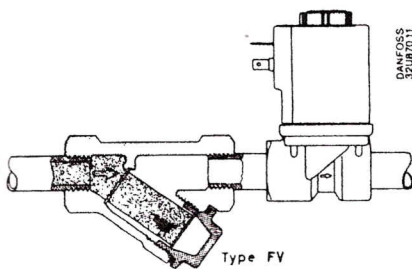


DANFOSS  
32U9620

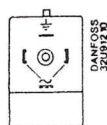
NB




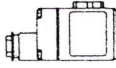
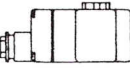
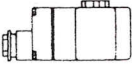
DANFOSS  
32U96711

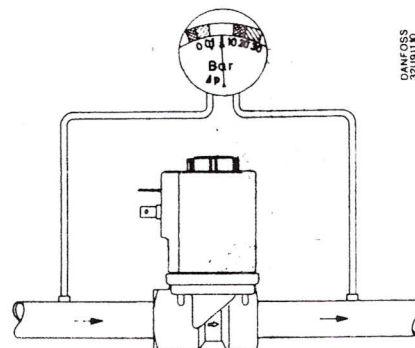


DANFOSS  
32U97011



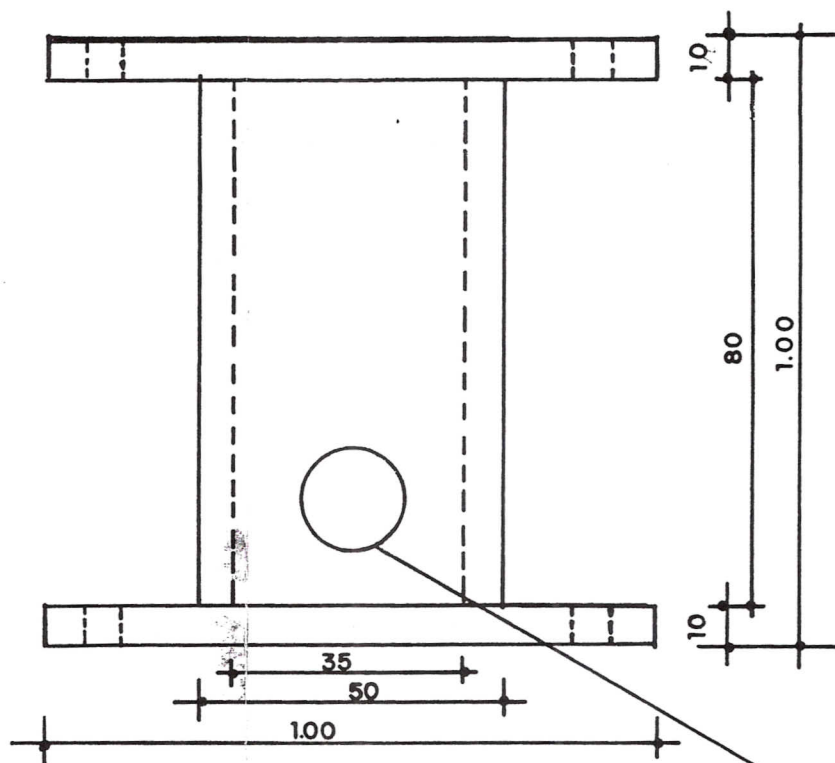
DANFOSS  
32U91230

$\Delta P$ (bar)					
		9W	10W	12W	20W
EVI 1.5	OLW	0-30	0-30	0-30	0-30
EVI 3		0-10	0-20	0-30	0-10
EVS 6	OL	0.1-20	0.1-20		0.1-20
	L	0.1-30	0.1-30		0.1-30
	W	0.1-20	0.1-20		0.1-20
EVS 10	OL	0.1-20	0.1-20		0.1-20
	L	0.1-30	0.1-30		0.1-30
	W	0.1-20	0.1-20		0.1-20



DANFOSS  
32U9110

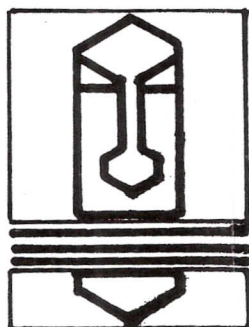
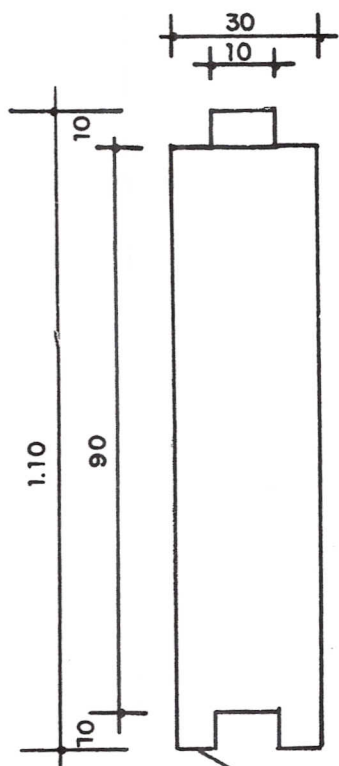
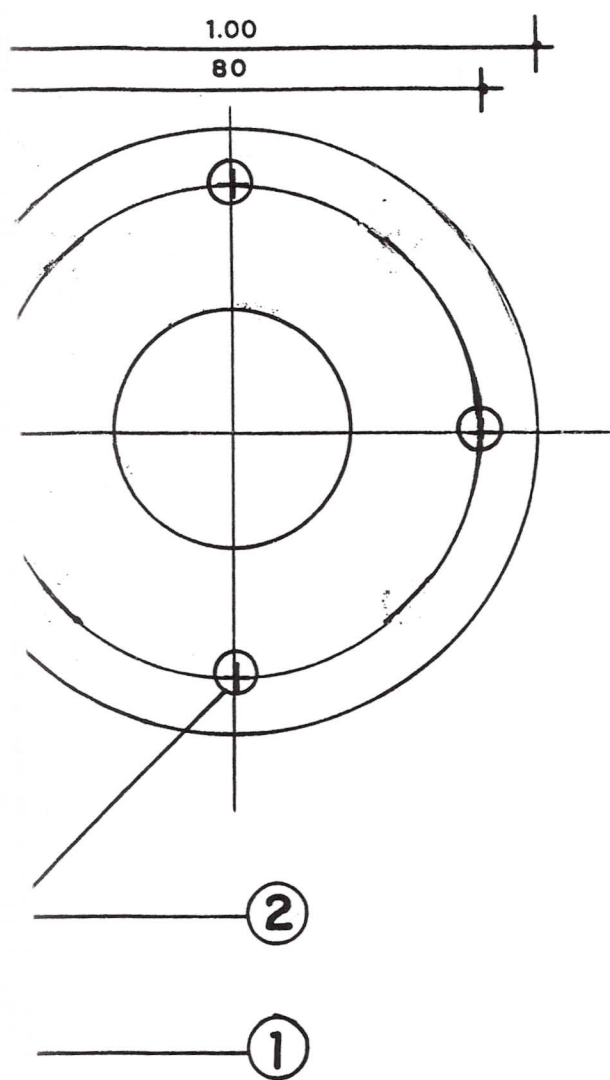




#### LEGENDA:

- 1 - JANELA PARA DRENAGEM COM  $\varnothing$  5/8"
- 2 - FURO COM  $\varnothing$  3/8"
- 3 - EIXO DE AÇO INOX

OBS. - O MATERIAL USADO PARA FABRICAÇÃO DA LUVA DEVE SER AÇO CARBONO.



LUVA EXTRAVASORA  
DA  
VALVULA-MITTO



